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PART ONE

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J. B. HOEING, State Geologist

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## THE COALS OF LETCHER COUNTY

BY

A. F. CRIDER

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## LETTER OF TRANSMITTAL

TO HIS EXCELLENCY, A. O. STANLEY,  
*Governor of Kentucky.*

SIR—I have the honor to transmit herewith a report on the coals of Letcher County. This county not only includes practically all of the area where the justly celebrated Elkhorn coal has its best development, but contains also large areas of other valuable coals which will become available with the extension of the lines of the railroad systems now operating in this county or projected, and which will probably soon make of Letcher County the leading coal producing county of Eastern Kentucky.

Very respectfully,  
J. B. HOEING,  
*State Geologist.*

## PREFACE

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BY

J. B. HOEING.

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Letcher County lies in the deep part of the Appalachian basin. With the exception of some of the highest rocks on the summit of Black Mountain, the whole thickness of Pennsylvanian rocks found in the county is comprised within the Pottsville series, the portion above drainage, with the exception of the older Pottsville rocks brought up by the great Pine Mountain fault, all belonging in the upper part of the Upper Pottsville or Kanawha. The lower part of the Kanawha and the rocks representing the New River (Middle Pottsville) and Pocahontas (Lower Pottsville) are below drainage over the principal part of the county, and are only shown above drainage in the sandstones, shales and thin coals on the crest and southeast side of Pine Mountain, where they are brought up by the fault and stand at high angles of dip.

On the northwest face of Pine Mountain the displacement caused by the fault was great enough to bring up Devonian and Mississippian rocks, but these are only exposed in a comparatively narrow belt along the face of the mountain.

On the summit of Black Mountain, younger rocks are found than at any other point in the county, one of the heavy sandstones over the High Splint coal corresponding in position to the Homewood sandstone at the top of the Kanawha, and the remainder of the section from the top of this sandstone to the top of the mountain belonging in the base of the Alleghany series above the Pottsville. This is, with the possible exception of formations on the summit of Kentucky ridge at the head of Line



Fork, in the southwestern corner of the county, the only place in the county where Pennsylvanian rocks younger than the Pottsville are found.\* The Nuttall sandstone, the top member of the New River (Middle Pottsville), is the heavy sandstone at Elkhorn City, in Pike County, at the mouth of Elkhorn Creek, and is also the "Beaver" sand noted by oil well drillers all over the Big Sandy Valley. This sandstone goes under drainage just above the mouth of Elkhorn Creek and does not come to the surface anywhere in Letcher County, except along a narrow outcrop line on the southeast side of Pine Mountain, and the whole series of shales, sandstones and coals above the top of this sandstone, including the section which goes under drainage between the mouth of Elkhorn Creek and the Letcher County line, up to the top of the Homewood sandstone near the summit of Black Mountain, is Kanawha or Upper Pottsville. As explained above, however, this does not include the rocks from the base of the Pennsylvanian near the crest of Pine Mountain, to the top of the Nuttall sandstone where the latter is brought up in the Cumberland River valley on the southeast side of Pine Mountain, which are older rocks representing the Lower and Middle Pottsville.

#### THICKNESS OF POTTSVILLE

The rapidly increasing thickness of the Pottsville from the Ohio River to the southwest and southeast is well shown by the accompanying plate of sections (Plate 1). In order to illustrate this downward thickening of the measures it was necessary to assume some definite datum from which to measure.

The top of the Pottsville has been eroded from over much the largest portion of Eastern Kentucky and therefore could not be used, and the datum chosen is the old number one coal of the Kentucky Geological Survey.

\*The statements made in some recent publications that the Lee formation represents the Pottsville in Kentucky and that the Lee also represents all of what Crandall called the "Rockcastle Conglomerate Series" (the formations below the old No. 1 or Lily coal), are both serious errors. In Letcher County there are about 1200 feet of Pottsville rocks above the horizon of the Lily coal and the whole thickness of the Norton formation (about 1500 feet) between the Lily coal horizon and the top of the Lee.

This coal is well below the top of the Pottsville, but was taken for convenience and because its horizon can be closely identified over all the area under discussion. Its outcrop is well marked over the eastern coal field west of the Big Sandy drainage. On main Big Sandy River and the Levisa Fork it correlates very closely, at least, with the Paintsville-Van Lear coal and on Tug Fork with the Warfield and Freeburn coals. On Plate 1 the position of this coal is the datum from which all downward measurements to the base of the Pottsville are taken. Estimates are also given later of the amount of the thickening in the Pottsville rocks above this coal, and the sum of the two will give the total increase in thickness.

Referring to Plate 1, Section No. 1, is in Greenup County on the Ohio River. The total thickness from coal No. 1 to the base of the Pottsville is given as 60 feet. In places, however, this decreases to only a few feet and the underlying limestone also feathers out to a thin edge. Section No. 2 is a part of a well record in Menifee County. In this well, which is southwest from Section No. 1, the thickness from coal No. 1 to the top of the limestone has increased to 156 feet. Section No. 3 is from a well record in Morgan County, nearly south of Section No. 1, and the thickness from coal No. 1 to the limestone is 523 feet. Section No. 4 is from a well on the Big Sandy River in Lawrence County, and shows a thickness of 603 feet. Section No. 5, from a well drilled at Warfield in Martin County on Tug Fork of Big Sandy River, shows 824 feet from the coal to the base of the Pottsville. Section No. 6, southwest from Section No. 1, is a measured section near Stearns in McCreary County, near the Tennessee line, and also near the western edge of the eastern coal field. The interval between the No. 1 coal and the base of the Pottsville is 915 feet. Section No. 7 is from a well on Big Sandy River at Prestonsburg in Floyd County. Starting 72 feet below the Paintsville (No. 1) coal, it gives the interval down as 923 feet. Section No. 8 is in Whitley County and about 20 miles northeast of Section No. 6. The interval of 1060 feet shows an increase of 145 feet over Section No. 6 in that distance. Section No. 9 is from a well on Beaver Creek in Floyd County and shows an interval of 1062 feet. Section No. 10 is from

a well record near Chattaroy on Tug Fork of Big Sandy River as given by Dr. I. C. White, and gives an interval of 1335 feet. Section No. 11 is from a well record on Big Creek in Pike County and not far from Williamson, W. Va. The interval there is 1391 feet. Section No. 12 is from a combined section and well record near Cedar on Tug Fork just beyond the West Virginia line and is given by I. C. White. This section is the one farthest to the southeast from Section No. 1, and gives an interval of 2017 feet.

These records show an increase downwards in the thickness of that part of the Pottsville below the horizon of the No. 1 coal, from near the old Carter County axis on the Ohio River southeast to the West Virginia line on Tug Fork of Big Sandy River, of 1957 feet (from 60 to 2017), and of 855 feet (from 60 to 915) going southwest from the Ohio River to the western edge of the eastern coal field; also an increase of 1100 feet (from 915 to 2017) going across from this last point (Section No. 6) to Section No. 12 at the Tug Fork crossing of the West Virginia line. There is also an increase in thickness in that portion of the Pottsville between the horizon of the No. 1 coal and the top of the Homewood sandstone, or base of the Alleghany, of about 500 feet between the Ohio River and Section No. 12 at the West Virginia line, making the total increase in thickness between the two points  $500+1957$  or, in round numbers, about 2500 feet. As the Pottsville has a total thickness of about 700 feet on the Ohio River, the total thickness of the series at the West Virginia line is  $700+2500$  or about 3200 feet.

In Letcher County no deep wells have been drilled, and accurate measurements of the Pottsville cannot be obtained. The whole series is exposed in the upturned edges of the strata on the crest and southeast flank of Pine Mountain and on to the summit of Black Mountain, but the strata on Pine Mountain are exposed at steep and varying angles of dip, which cannot be measured very accurately or all in one locality, making a measurement of total thickness somewhat uncertain. Such measurements, however, as could be obtained, give a total thickness for the Pottsville in Letcher County of about 4000

feet as compared with the thickness given above, of about 3200 feet at Tug Fork of Big Sandy and 700 feet on the Ohio River.

#### THICKNESS OF PENNSYLVANIAN

The total thickness of the Pennsylvanian rocks, from the base on the crest of Pine Mountain to the summit of Black Mountain is about 4300 feet.

#### CORRELATIONS

In the general section of Pennsylvanian rocks given in this report, the top of the massive, pebble bearing sandstone, 270 feet thick, whose top is 985 feet above the base of the section, is probably the top of the Lee formation, giving a thickness of 985 feet for the Lee. The top of the sandstone under the Harlan coal is the top of the Norton, making the Norton about 1535 feet thick and the Wise formation about 1225 feet,\* the remainder of the section above the Wise being partly Kanawha and partly Alleghany, the 100 feet of sandstone under the Stamper coal probably representing the place of the Homewood sandstone.

#### CORRELATION OF COALS

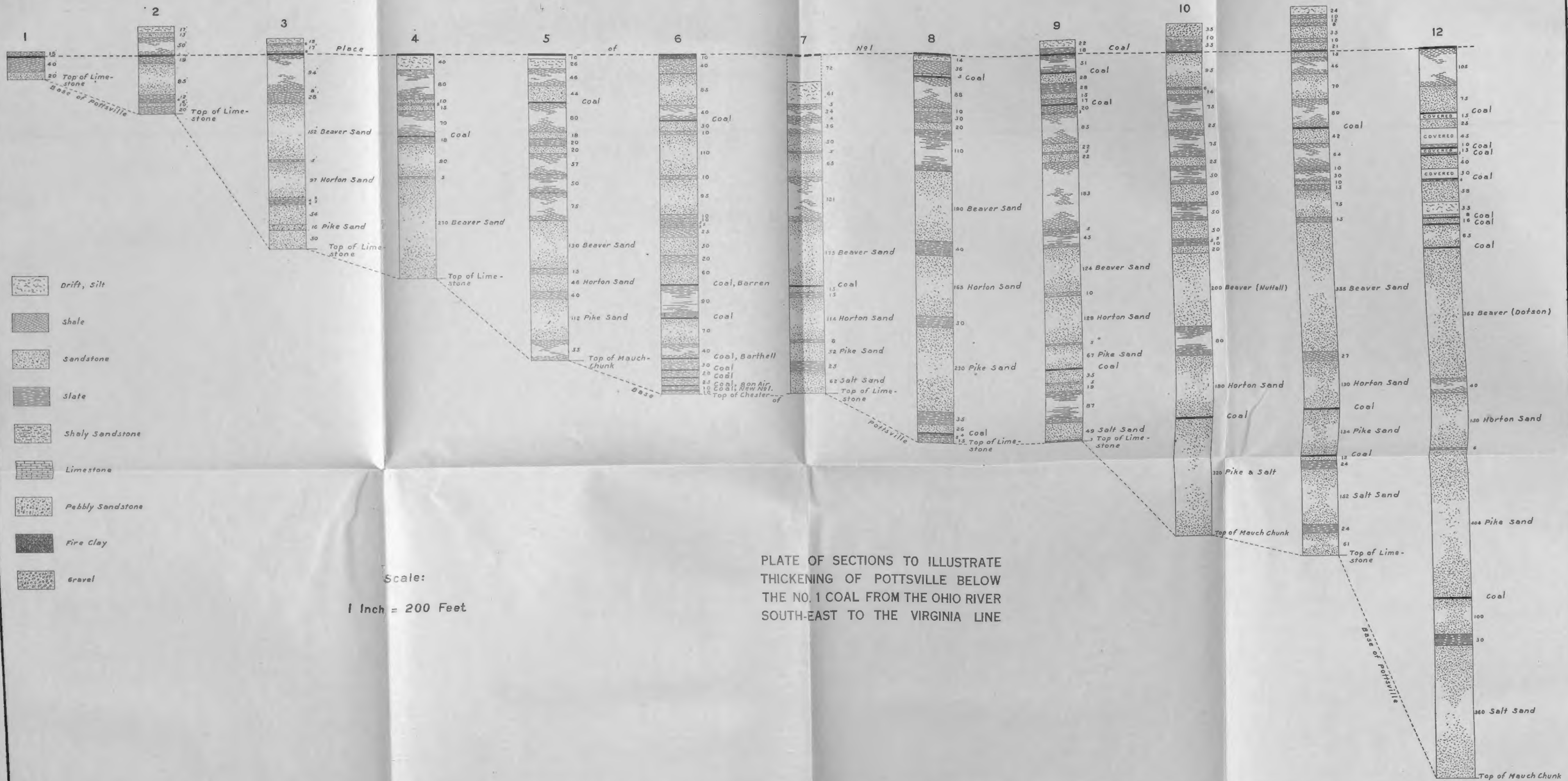
The correlation of the coals on the north side of Pine Mountain with those in the Cumberland River district and the adjoining states, has often been attempted, but with widely varying results. The openings on the Fire-clay coal on Black Mountain, as shown by Mr. Crider in the body of the report, make the correlation in the Cumberland River district comparatively simple, with the Fire-clay coal representing the Dean, the Elkhorn the Taggart, and the Hindman the High Splint. To the north, the Fire-clay coal again serves to carry the correlation across, the Fire-clay and the rider together making the Flatwood coal of Pike County and the Whitesburg, Fire-clay and rider representing the Chilton group

\*As explained previously, these estimates of thickness are necessarily only approximate.



of coals of West Virginia. It is quite probable also, that the Hindman-High Splint horizon in Kentucky represents the horizon of the Coalburg coal of the Tug Fork region of West Virginia.

In the portion of Virginia bordering on Letcher County there has been wide variance in correlations, this owing partly to the highly disturbed condition of the strata. It is fairly established now, however, that the Imboden coal, which has heretofore been correlated with the Edwards coal, is really several hundred feet higher in the section. The Taggart coal is the Elkhorn; the Fire-clay coal is, of course, the same in both sections and is about 800 feet above the Bolling coal, with which it had been tentatively correlated, and the Haddix and Hindman are respectively the Pardee and High Splint coals.



## INTRODUCTION.

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**LOCATION AND EXTENT.**—Letcher County is one of the counties of southeastern Kentucky bordering on the Virginia line and occupies a central position between Tennessee and West Virginia. The counties bordering Letcher are Knott and Pike on the north, Wise County, Virginia, on the east, Wise County, Virginia, and Harlan County, Kentucky, on the south and Harlan and Perry counties, Kentucky, on the west.

Pine mountain crosses the county in the southeastern part in a northeast-southwest direction, dividing the county into two distinct physiographic districts. That part lying northwest of Pine mountain forms the source of the main, or North, fork of Kentucky river and is known as "the North Fork district." Cumberland river rises in and flows through that part of the county lying southeast of Pine mountain and that portion of the county is known as "the Cumberland country." The total area of the county is approximately 331 square miles, with 269 square miles northwest of the crest of Pine mountain and 62 square miles in the Cumberland river district.

**LITERATURE AND ACKNOWLEDGMENTS.**—The first mention of the coals of Letcher County, so far as the writer has any knowledge, is that made by Dr. David Dale Owen in Volume I, Kentucky Geological Survey, 1856. On a trip up the North fork of Kentucky river across to the head waters of Elkhorn creek, he mentions some thin coals along the North fork from Kings creek to the head of the river and also on Shelby creek. A general section of Pound Gap is also given.

In Volume IV, Part IV, Kentucky Geological Survey, 1878, a geological reconnaissance of the region adjacent to the Kentucky and Virginia state line from Cumberland Gap to Big Sandy river, by Mr. P. N. Moore, is given. The author gives the geographic location of Cumberland, Pine, Big Black and Little Black mountains

and the principal streams of this region. Only a very general discussion of the geology is attempted. No general sections are given.

Kentucky Geological Survey, Volume C, Part 2, 1885. In a report on the Pound Gap region, by Prof. A. R. Crandall, the author describes in some detail the geography, topography, structure and geology of the region of the headwaters of North fork of Kentucky river, Shelby and Elkhorn creeks of Big Sandy river, and the upper waters of Poor fork of Cumberland river, giving numerous sections of the strata and individual coal beds; also cross sections of Pine, Black and Cumberland mountains and the intervening valleys.

Bulletin 111, U. S. Geological Survey, 1893, Geology of the Big Stone Gap Coal Field of Virginia and Kentucky, by Mr. Marius R. Campbell. This report deals principally with the region south of Big Black mountain in Virginia, and the Harlan field in Kentucky, with a reference to the coals on Lewis creek in Letcher County. The two key rocks of the region between Pine and Stone mountains given by the author, are the Harlan and Gladeville sandstones. The coals on the north and south sides of Black mountains are correlated largely by these two sandstones.

Bulletin No. 4, Kentucky Geological Survey, 1905, by Prof. A. R. Crandall, gives a map of Elkhorn creek, and the waters of North, Potters, Wrights, Boone and Yonts forks, with a general section of the region; also individual coal sections and analyses of coals.

Bulletin 348, U. S. Geological Survey, 1908, Coal Resources of the Russell Fork Basin in Kentucky and Virginia, by Mr. Ralph W. Stone. The author gives a generalized section of the strata from the top of the Lee conglomerate to the Flatwoods coal, and individual sections of a number of openings on the Elkhorn coal on Elkhorn creek. In the same report tentative correlations, based on Paleobotanical data, of the coals of this region with those further down Big Sandy river are given by Dr. David White.

Bulletin 13, Kentucky Geological Survey, 1912, The Upper Cumberland Coal Field, by Mr. J. M. Hodge. The author gives a general description of the coal beds with

intervals between each, with cross sections from Stone to Pine mountains and beyond, showing the synclinal basin in which the coals of this region occur. Sections of the strata on different streams together with a large number of detailed coal sections and analyses of coals are given.

In Series IV, Volume I, Part I, Kentucky Geological Survey, 1913, Mr. J. B. Hoeing for the first time correctly correlates the thick coal now worked so extensively at Jenkins, McRoberts and Fleming with the Sandlick and Rockhouse coal of the North fork and the Alma coal of the Tug fork region. In all of the previous reports there was much confusion when the correlation of the coals in different parts of the field was attempted. The work of the past summer, 1915, has fully corroborated the conclusions reached by Mr. Hoeing.

Bulletin 541-F, U. S. Geological Survey, 1914, The Coal Resources and General Geology of the Pound Quadrangle of Virginia and Kentucky, by Mr. Charles Butts. The author separates the Pennsylvanian into four formations on both sides of Pine mountain and marks the outcrop lines of the four principal coals on the Kentucky side. A general section of the strata in Kentucky is made and a correlation of the coals with those on the Virginia side is attempted. In his report Mr. Butts tentatively correlates the Fire-clay or Hyden coal north of Pine mountain with the Bolling coals of the Big Black mountain district. During the past summer, 1915, the present writer found the Fire-clay or Hyden coal, which is easily recognized by the 4-inch parting of hard flint fire-clay, about 900 feet above the Bolling coals and 200 feet below the Pardee or Limestone coal.

In addition to the above published reports the writer desires to acknowledge the receipt of a typewritten copy of a report on the coals of the Swift Coal and Timber Company's property, embracing all that part of Letcher County lying west and north of Line fork, from the mouth of and including Turkey creek, to the head of Line fork. The report was written by Mr. Charles Conner. A large scale map of the region showing the outcrop lines of four of the principal coals, together with numerous sections of individual coal beds opened by the company, were also

turned over to the survey. The engineer in charge of the work was Mr. C. H. Burton, and the field surveying and mapping were done by Mr. S. H. Fields, both of Whitesburg.

The thanks of the survey are due the Consolidation Coal Corporation of Jenkins, for maps, individual coal sections and elevations of coal in the Elkhorn field, and for other courtesies extended the writer.

The Blackwood Coal and Coke Company of Pardee, Virginia, through the courtesy of the general manager, Mr. C. J. Creveling, supplied the survey with a large scale map showing the outcrop lines of four of the coals of Big Black mountain from Smith creek to the head of Collier creek of Poor fork, together with detailed sections of coals opened by the company in that region.

To the Elkhorn Coal Company of Kona, and to the Southeast Coal Company of Seco, the writer is indebted for sections, maps and other valuable information.

The writer was assisted during the greater part of the field season by Mr. Charles E. Straub. Mr. Straub's work is so designated in the following pages.

The analyses of the coals of this report were made, partly from samples collected by the writer and Mr. Straub, in the laboratory of the Kentucky Agricultural Experiment Station under the direction of Dr. A. M. Peter, and partly in co-operation with the U. S. Bureau of Mines at their laboratories in Pittsburgh, Pa.

The elevations given in the report are above sea level as a datum. Most of those given on the Elkhorn coal of the upper waters of Kentucky river and on Elkhorn and Beethide creeks, are spirit levels furnished the survey by the Consolidation Coal Company and the Elkhorn Mining Corporation.

Many of the elevations on the Fire-clay coal on the west and north sides of Line fork are likewise from spirit levels made under the direction of Mr. C. H. Burton of the Swift Coal and Timber Company.

The remaining elevations were principally determined by aneroid by checking on the numerous U. S. Geological Survey bench marks in the county.

### TOPOGRAPHY.

The topography of Letcher County presents a type that is peculiar to this section of Kentucky. The prominent features are, the North fork drainage basin, Pine mountain, Big Black mountain and Poor fork basin.

Originally, the surface of the region of which Letcher County is a part, was a plain gently sloping to the north-west. The crests of the ridges from Pine mountain to the western edge of Letcher County, rise to a uniform plain and show a slope of this now dissected plain to the north-west at the rate of about 34 feet a mile.

Erosion has since channeled out the stream valleys leaving the slopes of the ridges bordering the valleys steep and rugged. In practically all of the county the streams are still eroding the bottom of their channels, as shown by the absence of broad alluvial bottoms in the generally V-shaped valleys. North fork and all of its main tributaries in Letcher County are cut to grade to near their headwaters, making the construction of railroads up these valleys an easy task.

In this type of topography the streams have steadily pushed their headwaters back until there are practically no level inter-stream areas that are not thoroughly drained. The crests of the divides between the streams are generally sharp. A cross section at right angles to parallel streams and their intervening ridges would show a series of acute angles with a V-shape for the valleys and A-shape for the ridges. Where coal beds occur near the base of the hills they have large areas and corresponding small areas where they occur high in the hills.

The slopes of the valleys are determined by the character of rocks and the general elevation of the country above sea level. Where the elevation above sea level is as great as it is in Letcher County the streams cut the bottoms far more rapidly than the sides of the valleys. The shales and hard sandstones which largely predominate in the Pennsylvanian series, form the bed rock of the entire county, except a narrow strip of Mississippian and Devonian rocks exposed in Pine mountain.

When the hard sandstones are once cut through by a stream they form much steeper slopes than those on the softer shales. On many of the streams vertical cliffs



twenty, fifty and even seventy-five feet high, are formed by the streams cutting through the hard sandstone beds.

The lowest point above sea level in Letcher County is on North fork where it crosses the western border of the county. At the mouth of Line fork the elevation is approximately 950 feet. In Paynes Gap, at the head of North Fork, the elevation is approximately 1850 feet. The crests of the ridges at the head of Wrights fork, attain a maximum elevation of slightly more than 2400 feet. At the head of Bull creek, on the Letcher-Knott county line, the ridge rises to slightly more than 2100 feet. The crests of the ridges between the streams which head on the northeast side of Pine mountain, rise from 500 feet to 1000 feet, and in a few places, 1500 feet above the streams.

The lowest point on Cumberland river in Letcher County (where Poor fork crosses the Letcher-Harlan line), is about 1525 feet, which is 275 feet higher than the North fork of Kentucky river at the mouth of Boone fork and 575 feet higher than the lowest point on the North fork. There is a fall of 500 feet in Cumberland river from the mouth of its most southeastern tributary, near Flat Gap, to the western boundary of Letcher County, a distance of about 12 miles.

The highest crests of Big Black mountain rise to an elevation of about 3650 feet. Kentucky ridge, north of Pine mountain, at the head of Line fork, rises to an elevation of more than 3000 feet. The highest points near the western edge of the county at the head of Bull creek, rise 2100 feet above sea level.

The crest of Pine mountain rises 1000 to 1800 feet above the northeast base of the mountain within less than a mile distance. The southeast slope is more gentle and corresponds approximately to the dip of the basal Pennsylvanian sandstones.

The crest of the mountain in Letcher County maintains a fairly uniform elevation of approximately 3000 feet. The maximum elevation is at the head of Poor fork of Cumberland river near the Virginia state line and reaches 3265 feet above sea level. The lowest point is at Pound Gap, which is 2407 feet above the same datum.

Forming the southern boundary line between Letcher County, Ky., and Wise County, Virginia, Big Black mountain rises 385 to 1000 feet higher than Pine mountain. From the main ridge a number of secondary ridges extend northward into Letcher County between the tributary streams of Poor fork of Cumberland river. Barn ridge, Little Fork ridge and River ridge are the three most prominent of these.

Big Black mountain, with its numerous projecting ridges to the north and south, presents a type of topography entirely different from that of Pine mountain. That presented by Pine mountain is the effect of a sharp folding of the strata accompanied by an overthrust fault, giving rise to a steep scarp on the northwest side and a more gentle slope to the southeast. The line of fault is remarkably straight, being about N. 60° E.

The topography of Big Black mountain is that presented by erosion of horizontal or slightly tilted strata. The streams on either side are well adjusted and form fairly uniform grades that are commensurate with the volume of water carried by them. The crests of the mountain are sharp and the slopes steep. In only a few places are there any level lands on the crest.

Between the crests of Pine and Big Black mountains is a basin four to six miles wide that is drained by Poor fork of Cumberland river. It is a topographic unit and differs in its origin from the region north of Pine mountain.

The strata of Poor fork basin form a portion of a great syncline. The two great uplifts bordering this structural basin are Pine mountain on the northwest and Stone mountain on the southeast, with Big Black mountain occupying a portion of the basin between.

Poor fork of Cumberland river flows at the southeastern foot of Pine mountain parallel to the strike of the rocks and the crest of the mountain and a short distance north of the trough of the syncline. The stream has been cut to grade to a point  $\frac{1}{4}$  mile from Flat Gap on the line between Kentucky and Virginia, and flows in a well marked V-shaped valley.

There are short stretches of narrow but flat valleys on Poor fork and its main tributary, Oven fork, due to

the change of stream beds from a soft shale to harder sandstones. The valleys occur where the shales form the surface materials in which the streams are now cutting, with hard sandstones below and above, which retard the action of the streams.

#### DRAINAGE.

North of Pine mountain the drainage in Letcher County is by two drainage systems, the North fork of Kentucky river and tributaries of Big Sandy.

North fork, which is generally regarded as the main trunk stream of Kentucky river, has its source in Pine mountain in the northeastern part of Letcher county. From here to where it leaves the western boundary of Letcher, it receives the waters from twelve large tributary streams besides numerous smaller ones. There are no falls of any extent in the North fork or any of its large tributaries in the county, this making it possible to construct railroad lines on a fair grade up any of the large streams almost to their sources. The average fall in North fork from the mouth of Line fork to Fleming is 10 feet to the mile.

The fall in Rockhouse creek from the mouth of Stevens fork to the mouth of Rockhouse, a distance of 24 miles, is 370 feet, or a little over 15 feet to the mile.

From the mouth of Dry fork of Line fork at the foot of Pine mountain to the mouth of Line fork, a distance of 15 miles, the difference in elevation is 200 feet, or a fall of 15 1/3 feet to the mile.

Big Sandy drainage is represented by the waters of Beehide above Booker branch, and those of Elkhorn creek above Marshall branch. The area of Letcher drained by Big Sandy waters is approximately 15 square miles.

Beehide drains a small area in the extreme northeastern part of Letcher, flows a little east of north and unites with Shelby creek, which flows into Big Sandy river 5 miles above Pikeville.

Elkhorn creek has its source across the ridge from the headwaters of Wrights fork of Boone fork of Kentucky river, and flows due south to the foot of Pine mountain where it unites with Little Elkhorn creek. From here to the eastern edge of Letcher County and thence to

where it unites with Big Sandy river at Elkhorn City, it flows at the foot of and parallel to Pine mountain.

Poor fork of Cumberland river drains all that part of Letcher County lying southeast of Pine mountain. Its drainage is confined between the crests of Pine mountain on the northwest and Big Black mountain on the southeast. The Kentucky-Virginia state line from Black to Pine mountains follows the divide between the waters of Poor fork of Cumberland and those of the South and North forks of Pound river.

The drainage of the southeast side of Pine mountain is by means of numerous short branches, many of which have cut deep canyon like gorges into the hard sandstone rocks. Most of these branches are less than a mile in length. Some idea of the maturity of the drainage may be gained by the great amount of erosion these short branches have performed. The heads of the branches have been pushed back to the very crest of Pine mountain, and where two branches head opposite each other the crest of the mountain may have been reduced in elevation as much as 300 to 800 feet.

Bad branch and Pine branch are the two largest northern tributaries of Poor fork. They occur up towards the head of Poor fork where the latter stream swings southward as much as two miles from the crest of Pine mountain. Below the mouth of Oven fork the main stream is from one to one and a half miles south of Pine mountain crest.

Lewis, Collier and Oven fork creeks are the largest tributaries of Poor fork on the south. These three streams head back near the crest of Big Black mountain.

With the exception of Bad branch, the streams entering Poor fork on the north are usually a single stream with little or no lateral drainage. On the south the majority of the streams, even though they may be shorter than those of the north side, show a more branching or dendritic structure.

Poor fork is cut to grade throughout the county to a point at the foot of Pine mountain opposite Flat Gap, making the construction of a railroad up Poor fork, thence through the low gap (Flat Gap) and on to the waters of Pound river, Virginia, a feasible proposition, as

far as grades are concerned. The fall in the river from near the head at Flat Gap to the western edge of the county, a distance of 16 miles, is about 540 feet, or 34 feet to the mile.

Railroad grades are feasible up Colliers creek and likewise up Franks and Smith creeks to the foot of Big Black mountain.

The origin and limitation of the present Poor fork drainage basin are the results of the great earth movements which formed Pine mountain, making it a barrier at a right angle to the general slope of the plain and dip of the rocks. Thus the original northwest drainage from Big Black mountain across where Pine mountain now stands, was diverted to the southwest by the uplift of Pine mountain, forming the basin now drained by Poor fork of Cumberland river.

A study of the map of Poor fork from its source to the mouth of Clover fork will give, even now, some idea of the original drainage lines of the region before the uplift of Pine mountain. Many of the streams entering Poor fork on the south appear to be older than Poor fork. They have cut far back into Big Black mountain pushing the divide back as much as 8 miles from Poor fork, the wider valleys of these large southern tributaries than that of Poor fork indicating older valleys than that of Poor fork. The drainage of these large tributaries shows a net work of branching lateral streams not unlike the branching of a large tree. In this respect these large southern tributaries are in marked contrast to those of Poor fork that have developed since the formation of Poor fork. The branches of Poor fork that have developed since the uplift of Pine mountain and the formation of Poor fork are short, rarely more than one mile in length, single streams with little or no lateral drainage.

Martins fork, Clover fork, Clover Lick, Big Looney, Lewis, and Collier creeks, Oven fork and Meadow branch are from four to thirty miles long and have well established lateral and sub-lateral drainage.

It is probable that before the uplift of Pine mountain, Oven fork continued its present northwest course and joined Big Cowan creek. Colliers creek and perhaps Lewis creek, formed the headwaters of Kings creek.

Big Looney and Clover Lick creeks united to form the head of Line fork, and Clover fork and Martins fork formed the headwaters of the Middle fork of Kentucky river.

Pound river appears to have formed the upper extension of Shelby creek of Big Sandy. The large gap at Shelby Gap apparently was not made by any of the streams now occupying that region. Other large gaps just north of Pine mountain, now high and dry, are also the result of this pre-Pine mountain drainage.

The complete network of drainage permeating as it does the entire county, has greatly reduced the area of workable coals which appear above drainage. Those occurring near the base of the hills are least affected, the percentage of the coal area removed by erosion increasing the nearer the top of the hills the coals occur. Some of the thickest seams of coals in the county occur so near the crest of the sharp ridges that they are thereby rendered practically worthless, on account of their small area and inaccessibility. This is particularly true in the northwestern, western and southern parts of the county.

#### CULTURE.

Until recent years, agriculture and lumbering were the only pursuits of the people. Since the construction of the Louisville and Nashville railroad up North fork to McRoberts, and the Baltimore and Ohio railroad to Jenkins, coal mining has become the most important industry. For 1914 the total output of coal for the county was 1,539,070 tons and was outranked in eastern Kentucky only by Pike and Bell counties, which produced 2,636,262 and 2,433,201 tons respectively. The first production reported for Letcher County was in 1912. Thus in three years Letcher County has sprung from a non-producer to the third largest coal producer in eastern Kentucky and the fifth largest in the State.

Since the development of the coal mining industry, many of the farmers within a radius of 5 to 10 and in some instances 20 miles of the mining towns have turned their attention to the growing of vegetables for the consumption of those employed by the mining companies.

Roads that can be traveled by wagons and other vehicles, follow the main streams and cross from one stream to the other through low gaps in the ridges.

The Consolidation Coal Company has shown what can be accomplished in the construction of good roads with such materials as are found in the region, in the construction of the road from Jenkins to Fleming and from the latter place to Haymond. The company roads across the mountain are constructed on a five per cent. grade and are well drained and covered with crushed sandstone.

Over a large part of the county travel is by foot or horse back and much of the produce brought to the mining towns is in sacks swung across the backs of mules.

The county is now constructing a road on a 5 per cent. grade from Whitesburg to Fleming.

The construction of good roads in mountain counties is a feasible proposition, as has been shown in Wise County, Virginia, where hundreds of miles of excellent roads have been constructed, some of which are built across Black mountain. With competent engineers and plenty of money the construction of good roads becomes an easy task, but it is useless to build good roads unless ample provision is made for their maintenance, which is even more necessary in the mountain counties than in more level regions.

#### STRUCTURE.

The structural features of the strata of Letcher County are separable into three distinct divisions as follows: The Pine mountain uplift, the Poor fork syncline, and the North fork region.

**PINE MOUNTAIN.**—Pine mountain is the most northwestern of a series of parallel ridges with intervening troughs or synclines, the whole of which compose the Appalachian mountain range. It is a ridge which began as a closely folded anticline, the southeast force continuing until the fold was broken into a fault on the northwest side throughout the greater part of its course. It is a narrow ridge parallel to the strike, with a general direction throughout the county of N. 60 degrees east. The

deviation from this general direction throughout the entire length of the mountain is very slight. The fault which ~~commences~~ the mountain occurs on the northwest side.

~~DISTANCE TO THE SOUTHWEST THE FAULT IS DOUBLE~~ and between the two fault planes the basal pebble bearing sands of the Pennsylvanian was brought to the surface. It is in addition to the sandstone of the same age which forms the crest of Pine mountain. This outer or northwest fault gradually approaches and finally merges with

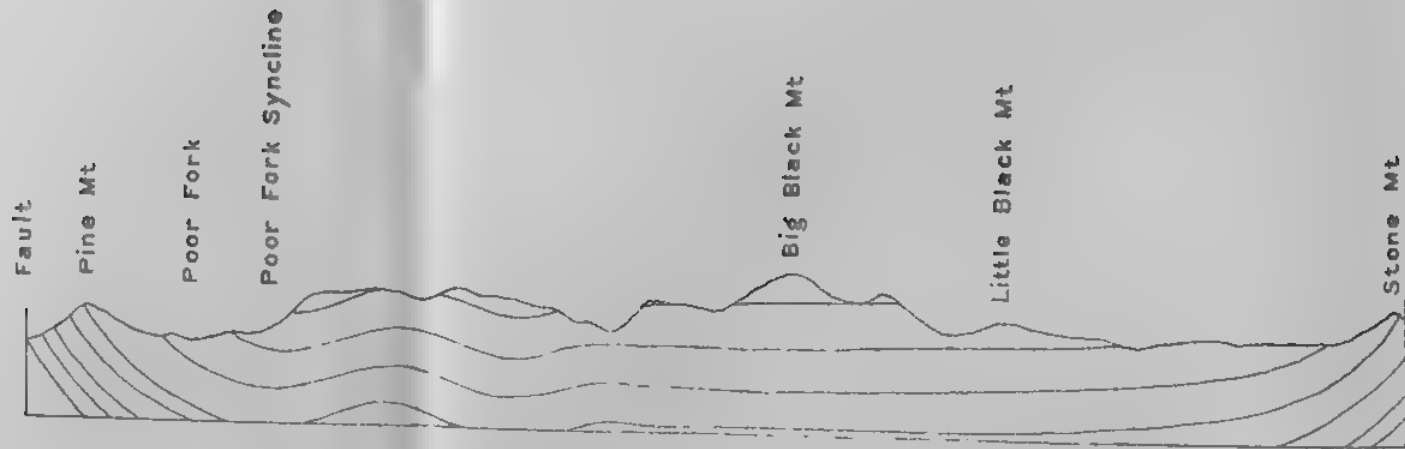


FIG. 1.--CROSS-SECTION FROM PINE MOUNTAIN TO STONE MOUNTAIN





FIG 1. CROSS-SECTION FROM PINE MOUNTAIN TO STONE MOUNTAIN

deviation from this general direction throughout the entire length of the mountain is very slight. The fault which accompanies the mountain occurs on the northwest side. In places it is a single break which is located far up toward the crest or it may be far down and even at the foot of the mountain, or the single break may change to a more complicated form of faulting in which a segment of strata, from an unknown distance below the surface, has been forced to the surface between two faults. The nature of this is described on a succeeding page.

The main fault abuts on the northwest side against slightly disturbed strata of Pennsylvanian age. In the plane of the fault the rocks stand at a comparatively low angle and dip away to the southeast. A few feet southeast of the fault plane the southeast dip is from 30 to 32 degrees and gradually lessens in that direction until a point is reached, generally from 2 to 4 miles from the crest of Pine mountain, where the dip changes from the southeast to the northwest. (See figure 1.)

Pine mountain was formed by a thrust from the southeast which broke the rocks for hundreds of feet below the surface and forced up the basal members of the Pennsylvanian until they now form the crest of the ridge.

The slight amount of erosion and retreat of the crest from the fault plane is in part due to the great resistance offered by these sandstone members, which are coarse grained, ferruginous, and contain more or less rounded quartz pebbles cemented into a conglomerate.

While the main thrust fault accompanying the sharp anticlinal fold throughout the greater part of the length of Pine mountain forms the principal break in the strata, there are local areas of primary and secondary faulting and minor disturbances in the nature of adjustment faulting.

With Jenkins as the center and for a distance extending about 4 miles to the northeast and the same distance to the southwest the fault is double and between the two fault planes the basal pebble bearing sandstone of the Pennsylvanian was brought to the surface. This is in addition to the sandstone of the same age which forms the crest of Pine mountain. This outer or northwest fault gradually approaches and finally merges with

the main Pine mountain fault to the northeast and southwest of Jenkins. The main Pine mountain fault extends across the full width of the county and beyond and is approximately parallel to the crest of Pine mountain. At Jenkins the horizontal distance between the two faults is about 500 feet. The vertical displacement caused by this fault brought the basal member of the Pennsylvanian close to the crest of Pine mountain and exposed the full thickness of the Mississippian rocks and along a part of the mountain, a portion of the Devonian rocks, on the northwest face of the mountain. This vertical displacement is greatest in the neighborhood of Pound Gap, where the displacement caused by the first fault is also most prominent, and decreases to the northeast and southwest.

The secondary movement was of greater violence than the first. The pebble bearing sandstone which barely reached the surface in the first movement was, in the second movement, forced about 1500 feet higher, or to the crest of Pine mountain, exposing the older strata, on the northwest side of the mountain from the basal Pennsylvanian to and including a part of the Waverley shale.

From near the mouth of Road fork of Jakes branch of Line fork to the head of the latter stream is a disturbance the nature of which is entirely different from that in the region of Jenkins. The Line fork disturbance is an adjustment fault that developed subsequent to the main Pine mountain fault. As a result of the Pine mountain fault, in the region of Bear branch as the center, the strata just north of the main fault were lifted, developing a strain which was compensated for by a normal or adjustment fault branching off from the main fault a short distance west of the head of Line fork and extending in a northeast direction to near the mouth of Road fork of Jakes branch. (See map.)

Where the fault is first noticeable at the northeast extremity on Jakes branch, the angle of dip in the strata a few feet north of the actual break is about 30 degrees in a northwest direction. This angle increases to the southwest and at a point  $\frac{3}{4}$  mile west of Bear branch it is about 60 degrees, increasing to the southwest until the fault merges into the main Pine mountain fault a

short distance west of the western border of Letcher County.

**POOR FORK SYNCLINE.**—Lying between Pine mountain on the northwest and Stone or Cumberland mountain on the southeast is a large structural basin which is designated as the Poor fork syncline. The width of this basin from the crest of Pine to the crest of Stone mountain is about  $12\frac{1}{2}$  miles. In Letcher County the base of the trough, from which the strata rise to the northwest to Pine and to the southeast to Stone mountain, is about  $2\frac{1}{4}$  miles from the crest of the former. It is shown on the map as a black line, and divides the basin into two unequal limbs, the one on the southeast being the large limb and the one to the northwest the short limb. The strata on the crest of Pine mountain dip to the southeast at an angle of about 30 degrees. From the crest of Pine mountain to the base of the syncline the dip flattens rapidly, and the change in dip from the southeast to the northwest is very abrupt. On the south limb the strata rise gradually from the trough to within a short distance of the north base of Stone mountain, then they suddenly rise abruptly, within a short horizontal distance, to the crest of Stone mountain, exposing the upturned edges of a great thickness of Pennsylvanian and the full thickness of the Mississippian, the Waverlian and Devonian strata.

Within the area occupied by the Poor fork syncline in Letcher County, Black mountain rises to a height of a little more than 3650 feet above sea level, or 385 feet higher than the highest crest of Pine mountain.

The strata of Black mountain are nearly horizontal with a slight dip to the northwest. Black mountain is not a structural mountain in the sense that Pine and Stone mountains are, but is a hill that stands as a remnant of a high plateau that has been worn down by erosion.

**NORTH FORK AND BIG SANDY REGION.**—That portion of Letcher County lying northwest of Pine mountain forms a part of the Appalachian plateau, formerly a high table land but now greatly dissected by erosion. The structure of the rocks of this region is simple, with a

general northwest dip, at right angle to the trend of Pine mountain, of about 40 feet to the mile. Slight undulations in the strata in places increases this dip to as great as 100 feet to the mile; or, as a result of these undulations, there may be a reverse dip to the southeast, as shown by the contour map on the Fire-clay coal northeast of Jenkins.

The effect of the northwest dip, on any particular coal bed, which may be high in the hills adjacent to Pine mountain, is to carry it lower and lower to the northwest until it may eventually fall below drainage. The effect of the dip is well shown in the Elkhorn coal which, at the head of North fork, is at an elevation of 1600 feet above sea level. Between the mouth of Tolson branch and Rockhouse creek it sinks below drainage at an elevation of about 1000 feet above sea level, giving a dip of 34 feet to the mile. This angle of dip however is not as great as it would be if measured at right angle to Pine mountain.

In like manner the Fire-clay coal, which at the head of North fork, Wright and Potters forks, is high in the ridge with only a small workable area, is carried lower in the hills to the northwest and on the northwestern border of the county is low enough to carry a large workable area.

The northwest dip has likewise greatly increased the workable area of the Elkhorn coal in passing from the upper waters of Wrights and Yonts forks and Millstone creek of North fork to the waters of Rockhouse creek. On the latter stream it outcrops from a short distance below Millstone branch to near the mouth of Stevens fork, and at no place does it rise as much as 50 feet above the stream bed. From just below the mouth of Millstone branch to the mouth of Rockhouse creek the dip is greater than the fall of the stream and the Elkhorn coal lies 30 to perhaps 50 feet below the creek bed.

#### POOR FORK REGION.

The rocks above drainage in Letcher County consist of sandstones, shales, clays, coals and thin limestones of Pennsylvanian age with an aggregate thickness of over 4000 feet. The Pine mountain fault has also exposed rocks of Mississippian and Devonian age.

The lowest rocks exposed on the north scarps of Pine mountain are the black Devonian shales. The thickness of these shales cannot be stated definitely but is approximately 100 feet or perhaps as much as 150 feet. They outcrop at or near the foot of the mountain, stand at a high angle and dip to the southeast beneath rocks of Mississippian age.

Above the Devonian shales are exposed 1500 to 1600 feet of Mississippian rocks consisting of 400 to 600 feet of Waverly shales, 300 to 400 feet of Newman limestone, 700 to 800 feet of shales, thin limestones and sandstones above the thick limestone. The lower part of the thick shales consists of red shales which are known as the Pennington shales. The same succession of strata as shown in Pine mountain dip beneath the Pennsylvanian and reappear in the southeast scarp of Stone mountain.

As a result of the strong southeast dip from 1200 to 1500 feet of Pennsylvanian rocks are exposed from the crest to the southeast foot of Pine mountain. Continuing the section to the crest of Black mountain, the full thickness of the Pennsylvanian series in the county is exposed.

The lower 1000 to 1200 feet of Pennsylvanian are principally coarse, cross-bedded sandstones, the greater part of which carry, in places, rounded quartz pebbles varying in size up to 1 inch or more in diameter.

Interbedded with the pebble-bearing sandstones are thin beds of shale containing thin coals, none of which are worked or even opened in Letcher County, so that their presence is known only by outcrops and the fact that they have been encountered in drill holes on the southeast limb of the Poor fork syncline. Eight of these coals varying from 2 inches to 2 feet 6 inches in thickness are reported by Mr. Butts.\*†

Between the top of the pebble-bearing sandstone on Pine mountain and the Imboden coal are approximately 1400 feet of shales interbedded with sandstones, the former predominating. Within this interval are no less than eight coals all of which are less than 40 inches thick. Three of these coals are of sufficient thickness to be

\*Bulletin 541-F U. S. Geol. Survey, Plate IX.  
†Report above cited.

worked locally. The lowest of the three has been opened on Bad branch of Poor fork and is reported by Hodge† as 33 inches of coal with a 5-inch parting.

The same coal is opened on the left of the second branch above Meadow branch of Poor fork, where it is 33 inches thick, solid coal, with sandstone roof and shale bottom.

A short distance above is another coal which has been opened 850 feet above the mouth of Meadow branch of Poor fork and shows 30 inches of coal with three thin partings.

On the same branch near the mouth of the left fork, or Spring branch, is a coal under 50 or more feet of massive sandstone. The coal is reported to be 37 inches thick.

**IMBODEN COAL.**—The next coal of importance and the lowest one which gives any promise of commercial value in the Poor fork region, is one which has been opened near the junction of Smith and Franks creeks of Oven fork of Poor fork. It is opened in a number of places on small streams entering Poor fork, from the mouth of Oven fork to the western border of Letcher County. East of Oven fork it is not recognized until near the head of Cumberland river on Roberts branch, where it apparently correlates with the Bolling coals‡ of Pound river.

On Smith and Franks creeks the bed is 85 to 90 inches in thickness with a thick parting of shale and clay near the center. Numerous openings on this coal made by the Blackwood Land Company of Pardee, Virginia, on the east side of Smith creek and Oven fork, show the thick parting in the coal rapidly increasing in thickness and the two benches, a half mile east of the mouth of Franks creek, 15 feet apart. The separation begins near the mouth of Franks creek. Still further east on Roberts branch, near the head of Poor fork, and on South fork of Pound river in Virginia, the two benches are 15 to 30 feet apart.

To the west of Franks creek the two benches come closer together and at the mouth of Colliers creek the parting is only about 1½ inches thick.

†Bulletin No. 13, Ky. Geol. Survey, Page 222.  
‡U. S. Geol. Survey, Bulletin 541-F

The Imboden coal is below drainage in Letcher County on the north side of Pine mountain.

**KELLY COAL.**—Sixty to seventy-five feet above the Imboden coal is a coal which is generally known in Wise County, Virginia, and in Harlan County, Kentucky, as the Kelly seam. In places it is insignificant or it may attain a thickness of 3 to 5 feet.\* It occurs close below a massive sandstone 60 to 80 feet thick. More or less shale intervenes between it and the Imboden coal below.

In the Poor fork basin the Kelly coal is thin, nowhere attaining a workable thickness.

On the north side of Pine mountain it is probably represented in the general section of that region, by the thin coal coming 75 feet below the Shelby Gap coal.

**HARLAN COAL.**—In the Poor fork basin the first workable coal above the Imboden bed is the Harlan coal which is 140 to 160 feet above the former and 70 to 85 feet above the Kelly coal. In Bulletin 541, U. S. Geological Survey, this coal is called the Standiford coal. In Bulletin No. 13, Kentucky Geological Survey, Mr. Hodge calls it the Harlan coal in Harlan County, but on tracing it up Poor fork into Letcher County he is not certain of its horizon and confuses it with the Imboden coal at the mouth of Franks creek. On the north side of Pine mountain the Harlan coal is represented by the Shelby Gap coal.

On Franks and Smith creeks of Poor fork, where it is best developed, it is a double coal with 14 to 20 feet of sandstone between. The lower bench is most generally characterized by about 2 to 3 feet of black, fissile slate roof. This means of identification is present on Pound river, Virginia, on Roberts branch at the head of Poor fork and on Smith and Franks creeks. At one place on the latter stream, however, the black slate roof is entirely cut out by the overlying sandstone. The interval between the two benches is generally a hard massive sandstone. The coal crowns a massive sandstone which in the Poor fork region is about 80 feet thick. (Gladeville?)

The average thickness of the lower bed is 37 inches with something like one half splint. It is worked exten-

\*Bulletin 13, Ky. Geol. Survey, p. 59.

sively for local use and is regarded as an excellent domestic coal.

The upper bench is about 30 inches thick; on account of its thinness it is very little wrought.

**COLLIER COAL.**—In the Poor fork region the next coal above the Harlan bed is a double coal which is here designated as the Collier coal, from an opening on the Collier farm. The lower bench is 70 to 100 feet above the Harlan coal. The two benches are 15 to 20 feet apart and are separated by shale. The two benches on Smith and Franks creeks are each found about 30 inches in thickness, but thicken to the west; on Joe Day branch and Staggerweed hollow the lower bench is 38 to 42 inches in thickness.

On the north side of Pine mountain the Collier coals are represented by the Penny coal.

**TAGGART COAL.**—About 100 feet above the Collier coals is a coal that, on the upper Poor fork waters and across Black mountain in Wise County, Virginia, is known as the Taggart coal. In Bulletin 13, Kentucky Geological Survey, it is called the Keokee, and it is probably the Kellioka coal in Professional Paper No. 49, U. S. Geological Survey. Other names by which it has been known in Virginia are the "Darby," "No. 5," "McConnell" and "Roda."

On the north side of Pine mountain it is correlated with the Elkhorn coal. It is over 400 feet below the Fire-clay coal in Black mountain and about 100 feet above the Collier coal.

On Smith and Franks creeks it is composed of three benches with two clay partings of about 6 inches each. The upper parting generally contains two thin coal bands of about 1 inch each. The roof is a hard, black, fissile or cannel slate with shale above. In places the overlying sandstone cuts into the shale.

Close below the Taggart is a thin coal which is nowhere workable. At a distance of 45 feet below is a coal which, on Franks creek, is 12 to 26 inches in thickness.

Below Oven Fork the Taggart coal separates into two benches. On Collier creek they are 9 feet and on

Lewis creek 25 feet apart. The lower bench attains a thickness up to 5 feet, generally without parting, and is one of the most promising coals of that region. It is possible that the lower bench of the Taggart is the "C" seam, and the upper bench the "D" seam at Benham, in Harlan County. The lower seam at the latter place is worked almost exclusively as a coking coal.

The upper bench on Collier creek attains a thickness of 36 to 41 inches of coal without parting. Where it is separated from the lower bed by as much as 9 feet or more it can be worked in advance of the lower bed, but would be worthless if the lower bench is worked first.

**LOW SPLINT COAL.**—From 175 to 210 feet above the Taggart coal is a coal to which the name Low Splint coal has been given by Mr. Hodge, in Bulletin 13, Kentucky Geological Survey.

Its most eastward outcrop seen in the Poor fork region is on the east side of Smith creek where it is badly cut up by partings. It is reported by Mr. Hodge to be 42 inches thick on Franks creek. It thickens to the west and attains its greatest development on Collier creek where it has a thickness of 4 feet. At the latter place the main bed is separated from a thin 7-inch rider by 62 inches of soft, gray clay. Just above the rider is a black slate which contains numerous marine fossils. Above the coal is 30 feet or more of shale with a massive sandstone below.

Between the Taggart and Low Splint coals are three coals the uppermost of which is about 50 feet below the Low Splint. On the left fork of Colliers creek it attains a thickness of about 50 inches, but is separated into a number of benches with thin partings of clay and rash between. On the main part of Collier, below the forks, the Low Splint has separated into three benches which extend through an interval of 25 feet. The middle bench is here the thickest one, being somewhat greater than 4 feet.

From the characteristic marine fossils found in the black slate roof of the Low Splint and the 200-foot interval above the Taggart and the same interval below the next important coal on Black mountain, the Dean or



Fire-clay coal, the Low Splint is correlated with the Amburgy coal of the North fork region.

**DEAN COAL.**—With an interval from 385 to 425 feet above the Taggart coal and 200 feet below the Pardee or Limestone coal, is a bed that has been described by Mr. Hodge in Bulletin 13, Kentucky Geological Survey, as the Dean coal. On the North fork waters it is known as the "Fire-clay," "Dean," "No. 4," and "Hyden."

In Bulletin 541, U. S. Geological Survey, Mr. Butts tentatively correlates the Fire-clay coal with the Bolling coals, which would place it about 1150 feet below the Pardee or Limestone coal. On "Bunker Hill," on the right branch of Smith creek, the Dean coal, with its characteristic flint clay parting by which it is distinguished over the North fork region, occurs 260 feet below the opening on the Pardee coal. In the interval just given, however, no allowance was made for dip, which if corrected would give an approximate interval of 200 feet.

On the North fork waters the Dean coal carries a band of brown, chocolate colored, flint fire-clay which comes in the lower one-third of the coal; in places it forms the floor of the coal. At the "Bunker Hill" opening on Smith creek the flint fire-clay and "black-jack" rock are both present, but they occur within 12 inches of the top. The entire seam has thinned to about 30 inches and is badly cut up with partings. At the few places in Black mountain where it was seen it is too thin to be of any commercial value, but serves as a key rock in working out the stratigraphy of the Black mountain region and in making correlations with coals on the north side of Pine mountain.

The two coals, the Whitesburg 40 to 60 feet below and the Fire-clay rider 30 to 60 feet above the Fire-clay coal in the North fork region, have not been fully identified in the Black mountain section, although thin coals which show only in natural outcrops and correspond closely to the positions of these coals, were observed in a few places.

**PARDEE OR LIMESTONE COAL.**—Approximately 200 feet above the Dean coal is a thick coal which is now being

worked at Pardee, Va. It was given the name Limestone coal by Mr. Hodge\* because of its proximity to a fossil limestone 40 to 80 feet above it, but is known to most of the coal companies operating in Black mountain as the Pardee coal.

It maintains the same relation to the Dean coal below and the fossiliferous limestone above, in Black mountain, as the Haddix coal does to the Fire-clay coal below and the fossiliferous limestone above on the North fork waters and is here correlated with the Haddix coal.

The Pardee coal, like the Haddix coal north of Pine mountain, is subject to wide variations in the character of the bed. Between Roaring fork of Powell river and Smith creek and the forks of Franks creek it attains a thickness of more than 10 feet with only two thin partings near the top. The entire bed shows a remarkably uniform character from top to bottom. To the west of this region it separates into two or more benches which become 20 to 30 feet apart. One or perhaps two of the benches, where separated, maintains a workable thickness. The separation of the Pardee into two or more benches makes it difficult to identify in the southwestern part of the county except by means of the overlying fossiliferous limestone. The interval to the Taggart or Dean coals below is likewise affected, as shown on the right fork of Franks creek.

**CORNETT COAL.**—About 230 feet above the Pardee coal is a coal which in certain areas of Black mountain attains a thickness of 4 feet or more. It was called by Mr. Hodge† the Cornett coal. In the region of the Pardee mine at the head of Roaring fork of Powell river, Virginia, it occurs about 90 feet below the High Splint, next to be described. It has been opened on the Eolia and Stonega road on the north side of Black mountain under a massive sandstone. It is not known further west in Letcher County but is reported by Mr. Hodge on Clover fork, and Little Black mountain.

The Cornett coal is represented on the north side of Pine mountain by the Flag coal. It occurs at the base

\*Bulletin 13, Ky. Geol. Survey.  
†Report above cited.

of a massive sandstone which, in places in Black mountain, carries quartz pebbles.

**HIGH SPLINT COAL.**—The highest coal that has been worked in the southern part of Letcher County is known as the High Splint. It occurs 320 feet above the Pardee or Limestone coal and about 90 feet above the Cornett coal. At the head of Roaring fork on the south side of Black mountain, where it has the greatest development, it attains a thickness of  $6\frac{1}{2}$  feet of solid coal,  $5\frac{1}{2}$  feet of which is an excellent quality of splint.

It occurs at or near the base of a massive pebble-bearing sandstone which forms steep cliffs along the side of the mountain.

At the head of Smith creek the High Splint is so high in the ridges that it is above the low gaps. The southwestern dip carries it lower toward the Harlan County line and in Harlan County it has a comparatively large area but high in the mountains.

In quality, the High Splint coal ranks among the best coals of eastern Kentucky. An analysis given on a subsequent page shows it to contain over 14,800 B t. u. per pound as the coal comes from the mine.

A comparison of the interval between the Pardee coal and the High Splint coal on Black mountain with the interval between the Haddix coal, the equivalent of the Pardee, and the Hindman coal north of Pine mountain, points to the equivalence of the High Splint and Hindman coals. This correlation is further strengthened by the presence of a calcareous sandstone which comes 20 to 30 feet above the High Splint in Black mountain and of a similar rock at the same distance above the Hindman coal at the head of Daniels branch of Rockhouse creek of North fork.

About half way between the High Splint and the Cornett coals is a thin coal which occurs in Black mountain and which according to the above correlation would correspond to the Francis coal of the North fork region.\* This coal was not seen by the writer but is reported by some of the coal companies.

**COALS ABOVE THE HIGH SPLINT.**—At least two coals are present in Black mountain above the High Splint

bed. One of these outcrops on the Eolia and Stonega road, on the north side of Black mountain, close above the massive, pebble-bearing sandstone, about 60 to 70 feet above the High Splint coal; the other shows in the hill above the High Splint opening at the Pardee mine 110 feet above the High Splint coal.

The crest of Black mountain rises about 450 feet above the High Splint coal. A  $4\frac{1}{2}$ -foot coal 146 feet above the High Splint coal, is reported by the Blackwood Coal & Coke Company, of Blackwood, Virginia.

\*Ky. Geol. Survey, Series IV, Vol. 1, Part II, page 227.

## REGION NORTHWEST OF PINE MOUNTAIN.

The general section gives the relative positions of the coals and intervening strata of Letcher County north of Pine mountain. A general section of the region south of Pine mountain is likewise given. In the construction of these general sections, individual sections from various parts of the respective regions have been compiled as nearly as possible into one general section for each region. As intervals between coals vary from one stream to another and coals on one stream may come in and assume perhaps a workable thickness and then disappear before reaching another stream, these general sections can only be considered as approximately correct. They are intended to give a general idea of the region and to aid in a discussion of the individual coals, and will be supplemented by numerous local sections in which the local variations of thickness and intervals are apparent.

## GENERAL SECTION OF PENNSYLVANIAN IN LETCHER COUNTY.

	Feet.
Top of Black Mountain.	
Interval, mostly sandstone . . . . .	350
Coal stain (Stamper coal).	
Interval, mostly sandstone . . . . .	100
Coal stain.	
Interval, covered, shale top and bottom....	40
Coal stain.	
Interval, shale top and bottom, massive sandstone in center	35
Pebble bearing sandstone . . . . .	45
Interval, mostly shale . . . . .	30
High Splint coal.	
Interval, mostly sandstone . . . . .	45
Coal stain.	
Interval, mostly sandstone . . . . .	45
Cornett coal.	
Interval, mostly sandstone . . . . .	90
Covered . . . . .	10
Shale . . . . .	50
Covered . . . . .	40

## LETCHER COUNTY

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	Feet.
Shale . . . . .	30
Fossiliferous limestone.	
Shale . . . . .	90
Pardee (limestone) coal	
Sandstone . . . . .	35
Covered . . . . .	5
Sandstone . . . . .	35
Covered . . . . .	60
Sandstone . . . . .	40
Shale . . . . .	25
Dean (Fire-clay) coal.	
Sandstone . . . . .	45
Whitesburg coal.	
Massive sandstone . . . . .	35
Covered . . . . .	15
Sandstone . . . . .	80
Shale . . . . .	25
Coal stain.	
Shale . . . . .	35
Amburgy (Low Splint) coal.	
Sandstone . . . . .	50
Coal.	
Shale . . . . .	15
Coal.	
Sandstone . . . . .	25
Coal.	
Sandstone . . . . .	40
Coal.	
Sandstone . . . . .	70
Taggart coal.	
Sandstone . . . . .	15
Coal.	
Sandstone and shale . . . . .	30
Coal.	
Sandstone . . . . .	35
Collier coal.	
Massive sandstone . . . . .	65
Shale . . . . .	15
Harlan coal.	
Massive sandstone . . . . .	80
Shale . . . . .	30
Coal.	
Sandstone . . . . .	15
Shale . . . . .	15
Imboden coal.	
Shale . . . . .	15

	Feet.
Thin coal.	
Shaly sandstone	110
Sandstone	15
Coal and black slate.	
Shaly sandstone	80
Shale	30
Coal.	
Shale	45
Coal?	
Sandstone	110
Covered	170
Sandstone	40
Shale	110
Massive sandstone	95
Covered, sandstone at bottom	35
Shaly sandstone	20
Massive sandstone	140
Shale	65
Coal.	
Shale	15
Sandstone	35
Covered	15
Coal.	
Covered	20
Coal.	
Sandstone	35
Shale	80
Sandstone	15
Shale	20
Sandstone	30
Shale	25
Coal.	
Shale	25
Massive sandstone, pebble bearing.	270
Shale	35
Sandstone	25
Shale	50
Sandstone	180
Shale	20
Sandstone	170
Shale	15
Massive sandstone (base of Pennsylvanian)	220

There is a remarkable uniformity in the interval between the Elkhorn coal and the Fire-clay or Dean coal

throughout the county. It generally varies less than 15 feet on one side or the other of a 400-foot vertical interval.

Just half way between these two well known coals is a coal that is also remarkable for its persistency; it is known as the "Amburgy" coal. The interval, in a large number of sections, from this coal to the Fire-clay coal is 200 feet, with as constant an interval down to the Elkhorn coal.

On account of the persistency and the well defined positions of the three coals just mentioned they will be used as key rocks in the general discussion of the various coals.

#### COALS BELOW ELKHORN COAL.

**SHELBY GAP COAL.**—This coal has been opened on Elkhorn creek just above Shelby Gap station and at the mouth of McPeak branch, and will be known in this report as the Shelby Gap coal. It is the Lower Elkhorn coal of Stone and Butts.

The Shelby Gap coal is the lowest coal that has a workable thickness in Letcher County northwest of Pine mountain. It is from 214 to 260 feet below the Elkhorn coal with an average interval of 240 feet. It is easily recognized in this district by the presence of a band of laminated coal either in the center or upper half of the seam. Further north, in Pike County, the laminated coal more often comes at the top of the bed but may occur as a band near the center. At Shelby Gap, at the mouth of McPeak branch and on the head of Beefhide creek, it has a bench of bituminous coal at the top with the laminated coal near the center.

On Elkhorn creek, at and above Shelby Gap, the Shelby Gap coal varies in thickness from 34 to 37½ inches. Further north it is reported to average 4 feet in thickness.\*

It occurs about 75 feet above Elkhorn creek at Shelby Gap; at the mouth of McPeak branch it is only 5 feet above the bed of the creek, falling below drainage a short distance above. It is opened near the head of Johns fork of Beefhide with an interval of 240 feet below the Elkhorn coal. It occurs again on the waters of North fork

\*Bulletin 348, U. S. Geol. Survey, page 35.

from a short distance above Fleming to near Whitesburg, where it is generally too thin for a workable coal.

The thinning of this coal on the upper waters of Elkhorn creek and to the northwest is doubtless due to the splitting of the coal into two or three benches. On the upper waters of Elkhorn creek there is a thin coal under a black slate roof 13 to 15 feet below the main coal. To the northwest this interval increases to 25 feet.

Below the main Shelby Gap coal are three, perhaps four thin coals with intervals of 20 to 35 feet between each. These coals are all too thin to be workable in Letcher County.

**PENNY COAL.**—70 to 75 feet below the Elkhorn coal and 140 to 170 feet above the Shelby Gap coal, is a coal that is now worked at Penny station on Shelby creek, Pike County. It is a very persistent bed that occurs throughout the region where the Elkhorn coal is developed. It varies in thickness from about 2 feet on the head of Elkhorn creek to 4 feet at Penny station.

On the waters of North fork this coal is too thin to be of any commercial value. It is there separated into two benches which may vary as much as 20 feet apart. The lower bench may be detected by the presence of 2 to 5 feet of black slate above the coal.

At Penny station, Pike County, the Penny coal is mined on a commercial basis. In quality the coal is regarded as one of the best by-product coals on the market.

**ELKHORN LEADER.**—25 to 30 feet below the Elkhorn coal is a thin coal that is generally known on the upper waters of North fork and to the east as the Elkhorn Leader. It is persistent throughout the county wherever the Elkhorn coal is known and is one of the coals that serve to identify the Elkhorn where the latter has thinned and changed in character from what it is on the headwaters of Elkhorn creek and North fork.

The average thickness of this coal is 30 inches, varying from 10 to 12 inches as a minimum to 48 inches as a maximum.

**ELKHORN COAL.**—The position of the Elkhorn coal is 30 feet above the "Leader," 70 to 75 feet above the

Penny coal and 214 to 260 feet above the Shelby Gap coal. It is 200 feet below the Amburgy and 400 feet below the Fire-clay coal.

This coal develops its greatest thickness on the heads of Elkhorn creek and tributaries, and the headwaters of North fork, and its various tributaries as far down as Colly. On the lower part of main Colly a parting sets in which, on Sandlick creek, separates it into two benches with a thick parting of clay between.

On the north this coal continues with a slight thinning of the bed section to Beefhide creek and thence to the northwest, to Long fork of Shelby.

From a short distance below the mouth of Camp branch of Rockhouse to a short distance below the mouth of Stevens fork, the main bed is a workable coal, usually in a single bench without parting. It occurs near the base of the hills, rarely over 20 feet above drainage, and has a large area between the waters of Rockhouse and the larger tributary streams of North fork above Sandlick creek, and across to the waters of Big Sandy in Pike County. It falls below drainage on Rockhouse a short distance below Millstone branch.

On the waters of Rockhouse the main bed is separated from an upper bench, or rider, by an interval of 20 to 30 feet of shale or sandstone. The main, or lower bench, varies from 40 to 49 inches of solid coal. The upper bench, in places, attains a thickness of 30 to 36 inches but is less regular than the lower bench.

On the headwaters of North fork the upper bench, which on Rockhouse is 20 to 30 feet above the main bed, has come down until it unites with the lower bench with in places merely a knife edge parting separating the two benches. Then in a short distance the interval between the two benches may increase and the two become separated again by as much as 30 feet.

The uniting and separation of the two benches is best seen in mines 301 and 307 at Fleming. At the east entrance to the former the two coals are together with less than a half inch parting between the two benches. At the west entrance to the mine the two benches are 5 feet apart and from there to the entrance of No. 307



mine, a distance of 1000 feet, the interval between the two benches has gradually increased to 30 feet.

The main bed of the Elkhorn coal is itself generally separated into two benches by a clay parting. In some of the mines the parting separating the two benches averages 4 inches; in others the interval varies from 8 to 10 inches and in a few small localities to as much as 3 feet.

On the head of Elkhorn creek and across on the waters of North fork, the Elkhorn coal attains a maximum thickness of 14 feet, with an average thickness over large areas of 8 feet.

The dip of the rocks carries this coal from an altitude of 1500 feet above sea level at the head of Wrights fork, to an altitude of about 1175 feet above the same datum on Dry fork of Kentucky river below Whitesburg. From this point to the northwest it thins rapidly and disappears below drainage between the mouth of Mill branch and the mouth of Rockhouse creek.

There has been much confusion in the correlation of the Elkhorn coal in the various reports on this region. The coal here called Elkhorn is the one now extensively worked at Jenkins, McRoberts, Fleming, Seco and Kona. Its outcrop line in Letcher County is shown on the small map accompanying this report.

**COALS ABOVE THE ELKHORN AND BELOW THE AMBURGY.**—Between the Elkhorn and the Amburgy coals, an interval of 200 feet, are three coals none of which attains a workable thickness, except for local use. The interval between each varies, but their stratigraphic positions are well established.

The lowest of the three coals is the Elkhorn rider described above. Where it is not down on and forming a part of the Elkhorn coal, it is generally separated from the main bed with a fairly constant interval of 30 feet above it. The thickness of the rider, where separated from the lower bed, is generally about 30 inches of solid coal.

The second coal above the Elkhorn seam is a thin, unimportant coal, commercially, which comes at the top of a thick bed of shales and at the base of a massive, coarse

sandstone. It is approximately half way between the Elkhorn and Amburgy coals.

The third coal above the Elkhorn occurs 35 to 40 feet below the Amburgy bed. In some localities this bed thickens to a workable coal and may easily be confused with the Amburgy. On Smoot creek it occurs between two sandstone beds, the lower one of which extends down to the second coal above the Elkhorn coal.

**AMBURGY COAL.**—The Amburgy coal occupies a stratigraphic position about half way between the Elkhorn and Fire-clay coals. By reason of its characteristic roof, which is distinct from any other coal in Letcher County, it becomes a most valuable guide in working out the stratigraphy of the region. The roof, where characteristically developed, is a dark, calcareous shale containing well preserved marine fossils. This characteristic feature of the roof is widespread throughout the region north of Pine mountain.

On Colliers creek of Poor fork, south of Pine mountain, a coal was also found with the same marine fossils in the roof and occupying about the same stratigraphic position below the Fire-clay coal.

In places the marine fauna is displaced by plant impressions, or the entire shale roof may be cut out and the overlying sandstone rest on the coal.

The Amburgy is a very persistent coal throughout the county and over a large part of the county it is a workable coal. At no place does it attain any great thickness, the maximum being about four feet with the minimum rarely under three feet. In places it is cut up with partings which render it of little value.

In the earliest reports of the survey this coal was known as No. 3; then later Hodge called it the "Elkhorn coal"\* although it is really 200 feet above the Elkhorn coal. In the reports of the New Geological Survey† this error was corrected and the name Amburgy adopted for the bed.

**COALS ABOVE THE AMBURGY AND BELOW THE FIRE-CLAY COALS.**—The 200-foot interval between the Am-

\*Bulletin No. 11, Ky. Geol. Survey, page 12.  
†Volume 1, Series IV.

burg and Fire-clay coals contains three coals, one of which is a workable bed. The lowest one occurs about 50 feet above the Amburgy and is rarely more than 30 inches thick. It occurs at the base of a massive sandstone which is 35 to 40 feet thick.

The middle seam occurs in a thin bed of shales between two massive sandstones and is nowhere of sufficient thickness to be of even local use.

**WHITESBURG COAL.**—40 to 60 feet below the Fire-clay coal is a seam that is known throughout Letcher and adjoining counties as the Whitesburg coal. It is a persistent bed but varies greatly in thickness from a mere streak a few inches in thickness to 4 feet and more as a maximum. It is usually easily recognized by the presence of a black, fissile slate roof which in places becomes cannel slate. It is an important seam on the head of Sandlick, on Smoot creek, on Dry fork and in the region of Whitesburg, from which place it received its name. In places it carries from 1 to 3 feet of cannel coal in the upper part of the bed.

From Kings creek to the head of Line fork it is greatly cut up with partings or thinned to such an extent as to be worthless.

**FIRE-CLAY COAL.**—No other coal in eastern Kentucky has played such an important part as a horizon marker in working out the stratigraphy of the Pennsylvanian rocks as the Fire-clay or Hyden coal. Somewhere in the bed, usually below the middle of the seam, and not infrequently at the bottom, occurs a band of hard, flint, fire-clay that can never be mistaken when once recognized. The average thickness of this parting throughout the county is 4 inches. Its usual color is chocolate or gray. An impure form of flint fire-clay of a dark color and known as "jack-rock" is not infrequently found just above the purer chocolate clay.

So persistent is this flint clay parting that it is rarely absent from the coal. A sample of the flint clay taken from Stevens fork of Rockhouse was similar in every respect to that from the north side of Black mountain on Smiths creek, or from Long branch of Line fork.

The relative position of the Fire-clay coal is about 400 feet above the Elkhorn coal and 200 feet above the Amburgy. Forty to 60 feet below it is the Whitesburg seam and from 50 to 60 feet above is a coal that will be described later as the Hamlin coal. The three coals, the Fire-clay, Whitesburg and the Hamlin, occur at the top of three prominent benches which are within an interval of 100 feet. The position of the Fire-clay coal, where not exposed, is generally determined by the position and relationship of these benches.

The greatest thickness of the Fire-clay coal is north of the North fork where it likewise has the greatest area. It is above drainage in the northwestern part of the county and rises to the southeast and at the head of Wrights fork is near the crest of the ridge.

Wherever the Fire-clay coal has been used it has gained an enviable reputation as a domestic coal. It is extensively mined in the vicinity of Hazard, in Perry County, where its high reputation as a domestic coal has been thoroughly established.

Under the old system of correlating coals by number, the Fire-clay coal was known as No. 4, and is still thus known to many of the coal companies. In the southeastern part of the eastern Kentucky coal field and in the Black mountain region it is known as the Dean coal. In some sections it is known as the Hyden coal. The Fire-clay coal and its rider form the "Flatwoods" coal at the head of Marrowbone creek in Pike County.\*

**COALS ABOVE THE FIRE-CLAY COAL.**—Varying from 5 to 30 feet above the Fire-clay coal is a coal that is generally known as the Fire-clay rider. Throughout the greater part of Letcher County, where this coal has been opened or exposed naturally, the interval down to the Fire-clay coal is generally about 30 feet. It is a thin coal rarely attaining a thickness of over 30 inches.

**HAMLIN COAL.**—In Series IV, Volume III, Part III, of the Kentucky Geological Survey, Mr. J. M. Hodge in a report on Troublesome creek first used the name Hamlin for a coal which in that region comes 90 to 110 feet above

\*Kentucky Geological Survey, Series IV, Volume I, pp. 205 and 209.

the Fire-clay coal. In Letcher County the interval is generally about 30 feet less than the minimum interval given by Mr. Hodge on Troublesome. It is possible, therefore, that the coal which he calls Hamlin is the third coal above the Fire-clay coal; otherwise the interval in Letcher County has decreased. The coal here called Hamlin is the second coal above the Fire-clay bed. It is a very persistent coal but varies greatly in thickness and quality in different parts of the county. It is a valuable coal on the headwaters of Rockhouse where it is a solid coal 72 inches thick, and also forms the principal coal for domestic and future commercial use on Kingdom Come and Kings creek. In many parts of the county it is too thin to be of any commercial value.

**HADDIX COAL.**—The second coal of economic importance above the Fire-clay rider is known as the Haddix. It is about 200 feet above the Fire-clay coal.

Two thin coals were also discovered between the Haddix and the Hamlin, the upper one about 30 feet and the lower one 85 feet below the Haddix bed. Very little is known of these coals.

The Haddix coal, occurring as it does 200 feet above the Fire-clay coal, is generally so high in the hills that there is a comparatively small area of the county underlain by it. It has been opened in a few places on the waters of Rockhouse creek and west and north of Line fork, where it occurs low enough in the hills to give a large area of workable coal.

Forty feet to perhaps twice that distance above the Haddix coal is a thin, fossiliferous, impure limestone. This is apparently the only fossil limestone in the upper strata of the Pennsylvanian series in Letcher County, so that it and its rather constant interval above the Fire-clay coal form a reliable basis for the determination of the Haddix coal.

In the Black mountain region Mr. Hodge has designated the Haddix coal as the "Limestone coal." It is the coal extensively worked at Pardee, Va., and through Big Black mountain on to the Kentucky side, and is known there as the Pardee or Parsons coal.

The Haddix coal varies greatly in thickness. Where well developed it is one of the thick coals of Letcher County. On Cornetts branch of Line fork it is over 9 feet thick with one thin parting near the bottom. At the Pardee mine, Virginia, in Big Black mountain, it maintains a thickness of 10 feet or more over a considerable area. This unusual thickness may change in a short distance to two, or perhaps three, separate coals separated by intervals of shale or sandstone 20 feet or more in thickness. For this reason, therefore, thorough prospecting should be done by drill or openings before locating mining operations on this coal. It is an excellent coal but requires more prospecting before operating it than some of the coals that maintain a more uniform thickness.

**HAZARD COAL.**—Mr. J. M. Hodge\* in a number of reports on the coals of the three forks of Kentucky river, describes a coal that ranges from 60 to 100 feet above the Haddix coal, and gives to it the name of the Hazard coal. In individual sections he places the interval from the Haddix to the Hazard as low as 40 feet and as great as 160 feet. The interval is smallest in the northwestern part of the area covered by his reports, and gradually increases to the southeast toward the head of the three forks of Kentucky river.

In Letcher County the interval will vary from 125 to 175 feet with an average interval of about 135 feet.

Where the ridges are sufficiently high to give it plenty of cover the Hazard coal is generally a valuable coal. It ranges in thickness from 3 to 6 feet and in places even greater thicknesses are reported.

Except on the waters of Rockhouse, the upper waters of Line fork, and in Big Black mountain, the Hazard is so high in the hills that the areas of workable coal in Letcher County are small.

About half way between the Haddix and Hazard beds is a thin coal to which Mr. Hodge† has given the name "Young coal." It is not far from the horizon of the

\*In the following publications of the Ky. Geol. Survey the interval from the Haddix to the Hazard coals is given. Bulletin 11; Series IV, Vol. 1, Part II; Series IV, Vol. II, Part II.  
†Ky. Geol. Survey, Series IV, Vol. I, Part II, page 926.

fossil limestone which occurs 40 to 80 feet above the Haddix coal. It was only seen in Letcher County as a stain or thin coal, unopened.

**FLAG COAL.**—40 to 80 feet above the Hazard bed is a coal to which, in former reports of the survey in Perry, Knott, Leslie and Letcher counties, the name "Flag" is applied. It occurs on a prominent bench by which it is generally easy to locate. Immediately above is a hard cliff-making sandstone which forms vertical cliffs. On the face of these cliffs is a white fungus growth by which the rocks may be seen for long distances. Where the sandstone is high in the ridges, as it is over the greater part of Letcher County, it weathers by breaking loose from the parent ledge in huge blocks and slipping down the slopes. Some blocks are left perched far up on the hillsides, while vast numbers fill the ravines at the foot of the slopes.

At two localities, one on the head of Doty branch of Rockhouse, and the other on Cornett's branch of Line fork, small quartz pebbles were found in the massive sandstone above the Flag coal. On Doty branch the pebbles are very abundant; on Cornetts branch they are small and scattering.

On Doty branch the Flag coal is largely splint. The pebble-bearing sandstone rests directly on the coal which was apparently partly eroded before the deposition of the overlying sandstone.

The interval between the Flag and Fire-clay coals on Doty branch is 390 feet. The openings on the two coals, however, are about  $1\frac{1}{2}$  mile apart, so that the true interval may vary a few feet either way from the above. The interval between the two coals on Cornetts branch is about 30 feet greater than that given on Doty branch.

On the waters of Rockhouse and those of Line fork are the only localities north of Pine mountain where the hills are high enough to give any large working areas to the Flag coal, and even there the coal comes high in the hills and is difficult of approach.

South of Pine mountain the Flag coal is doubtless represented by the Cornett coal.

**HINDMAN COAL.**—The highest coal that has received much attention from prospectors and coal companies in Letcher County is known as the Hindman coal. It occurs from 120 to 170 feet above the Flag coal. On Daniel branch of Rockhouse where the Flag and Hindman coals have been opened, the lower half of the interval between the two is a massive cliff-forming sandstone similar to that described on a previous page. The upper half of the interval is shale or shaly sandstone.

The Hindman coal, where opened, varies from 5 to 6 feet without any hurtful partings.

Like the Flag and Hazard coals, the area of workable Hindman coal in Letcher County is restricted to the Rockhouse, Line fork and Big Black mountain districts, and even in these the coal is high in the hills. In each of the three areas just mentioned the fact that the coals are high in the ridges does not necessarily mean that the coal beds are so near the crest that the quality of the coal is affected. On the upper waters of Line fork and in Big Black mountain the crests of the ridges rise as much as 900+ feet above the Hindman coal. The greatest difficulty in utilizing this coal is in getting to it.

At the top of the massive, cliff-forming sandstone which crowns the Flag coal is a thin coal to which the name "Francis"\* has been applied.

**STAMPER COAL.**—The highest coal of which anything definite is known of its bed section is here designated the Stamper coal. On the south side of Turkey creek, near its head, it occurs 253 feet above the Hindman. The thickness of the coal in the one place where it has been opened, gave 50 inches of clean coal separated near the center by 16 inches of shale and bone.

A coal 150 feet above the Hindman coal was opened at the same locality where the Stamper coal was opened, but nothing was learned of its bed section.

Two coals which come above the Hindman are reported to have been opened on the right of Bear branch of Line fork. The lower one is reported to have a thickness of 4 feet.

\*Ky. Geol. Survey.—J. M. Hodge.

## DETAILED DESCRIPTION OF THE COAL BEDS.

Pine mountain forms a natural barrier that separates Letcher County into two unequal provinces. So distinct are the two districts that in describing the coals each district will be treated separately.

A correlation of the principal coals of both sides of Pine mountain was given under the general discussion of the coal beds. A description of the number of coals, the intervals between each, and the correlation of the beds of the north with those of the south side of Pine mountain, is also given in the general sections.

For convenience in discussing the coals a description of the various beds will be made by streams, beginning with the lowest tributary and ascending, taking each tributary in order. Reference to right and left is applied to coals or other objects when facing up stream. Travel in the mountains is confined almost exclusively to or near the stream beds and each stream, therefore, forms a small unit or independent district.

Analyses, excepting those made by the U. S. Bureau of Mines, were made at the Kentucky Agricultural Experiment Station under the direction of Dr. A. M. Peter, Chief Chemist.

## POOR FORK REGION.

It will be noted in the following description of coals on the waters of Poor fork, that only in three or four places are coals found on the left of this stream. The reason for this has been explained under the discussion of the structure of the region.

The lower 2000 feet or more of the Pennsylvanian rocks in this region are barren of any prominent coal seams. The lowest rocks of the Pennsylvanian outcrop along the crest of Pine mountain and dip to the southeast at an angle of 30 to 35 degrees at the crest, diminishing in the direction of Poor fork. About one mile south of Poor fork the southeast dip ceases and the rocks from there to Black mountain and beyond are level or assume a northwest dip. The 2000 feet or more of barren measures form the crest and southeast slope of Pine mountain and dip below the surface before reaching Poor

fork. Only the streams entering Poor fork from the Black mountain side, therefore, contain any workable coals.

## LEWIS CREEK.

Lewis creek has its source in Black mountain and drains also a small portion of Harlan County. The Taggart coal, which is here separated into two benches, is the most important coal seen on the creek. It is opened on the right, 1 mile up, at Joe McKnight's.

The following is a section at the mouth of the opening:

Taggart Coal.		
Sandstone.		
Coal—opening	closed—reported ..	36"
Shale . . . . .		25 ft.
Coal—lower bench		45½"
Elevation, 1821.		

One of the lower coals outcrops on the right, ¼ mile up. It is about 235 feet below the Taggart bed with a strong southeast dip which would perhaps increase the interval to equal that between the Taggart and Imboden coals. Mr. Hodge\* reports a coal partially opened at about this same location showing the following section:

Imboden Coal. (Hodge.)	
Shale.	
Coal .....	23"
Mother coal .....	½"
Coal . . . . .	4"
Knife edge parting.	
Coal . . . . .	2"
Shale . . . . .	2"
Coal .....	3"
Shale . . . . .	1"
Coal .....	?

Mr. Hodge, in the report mentioned, gives two or three coals on the right of Poor fork between Lewis and Collier creeks. He considers these lower coals than the lowest one exposed on Lewis creek.

\*Bulletin 13, Ky. Geol. Survey, p. 203.

## COLLIER CREEK.

The rocks on the lower part of Collier creek dip strongly to the southeast and gradually flatten out to the axis of the syncline which crosses the creek a short distance below the forks.

The lowest coal of any importance exposed on this creek is the Imboden, which has been opened on the left of the road  $\frac{1}{4}$  mile above the mouth of the creek. The following is a section of the rocks from the mouth of the stream to about 110 feet above the coal:

## Section at Mouth of Collier Creek.

Sandstone	30 ft.
Covered	25 ft.
Shale	20 ft.
Coal	2 ft.
Clay and shale	5 ft.
Sandstone	10 ft.
Covered about	20 ft.
Coal	
Rash and clay	5½"
Coal	1½"
Mother coal	19¾"
Coal	½"
Mother coal	18½"
Coal	½"
Clay floor	10½"
Shale	10 ft.
Sandstone	5 ft.
Shale	15 ft.
Coal	6"
Sandstone, massive on top, more shaly below	75 ft.

A half mile below the forks of Collier, on the right, on Rebecca Creech's land, the Taggart coal has been opened at an elevation of 1800 feet, but the opening is now closed. Eight feet above the opening the upper bench of the Taggart shows as a stain in the soil.

In the drain which empties into the creek at the Rebecca Creech house 270 feet of strata are exposed, beginning at the horizon of the Low Splint coal. The Low Splint coal here is separated into three benches extending through an interval of about 18 feet, as shown in the

section below. The middle bench is 53 inches thick and is apparently of good quality. The relationship of the Taggart to the Low Splint is shown in the section.

## Section at Rebecca Creech's.

Sandstone	30 ft.	
Shale	7 ft.	
Covered, shale near center.	18 ft.	
Coal crop, place of Dean coal		
Massive sandstone	45 ft.	
Covered, place of Whitesburg coal	5 ft.	
Sandstone	35 ft.	
Covered	15 ft.	
Sandstone, massive on top changing to slaty sandstone in lower part.	80 ft.	
Shale, siliceous in upper part, more aluminous at bottom	35 ft.	
Coal	1 ft.	
Shale	6½"	
Coal	4½"	
Shale	5 ft.	
Coal, bottom not seen	1 ft.	
Covered	7 ft.	
Sandstone	10 ft.	
Covered	162 ft.	
Coal		
Shale	Taggart	8 ft.
Coal		

The Taggart coal is opened at the forks opposite the school house, on the right of Right fork, and shows the following:

## Taggart Coal.

Stratified sandstone	10+ ft.
Coal, rider	36"
Shale	11 ft.
Coal	2"
Shale with hard iron-clay concretions	45"
Coal	2"
Clay	9 to 10½"
Coal	24"
Clay parting	0 to 1"
Coal	24"
Elevation, 1800.	



On the right of the right fork, 1 mile up, the Low Splint or possibly the coal 50 feet below it, is opened. The following is a section at the mouth of a wet entry.

#### Low Splint Coal.

Shale .....	10 ft.
Coal .....	14"
Splint .....	2"
Coal .....	7½"
Sandstone .....	½"
Coal .....	7"
Clay .....	3½"
Bone .....	3½"
Coal to water's edge .....	5"
Coal, under water .....	5" +
Elevation, 2000.	

Mr. Hodge, in Bulletin 13, Kentucky Geological Survey, reports a 41-inch coal with 2 inches of cannel slate roof and sandstone above, on a right branch of Right fork, 4 miles up. This coal was found 260 feet above the horizon of the fossiliferous limestone and was supposed to be of the High Splint bed. Further east the interval from the Pardee or Limestone coal to the High Splint bed is 320 feet, and the fossiliferous limestone is 60 to 70 feet above the Limestone coal. An interval, therefore, of 260 feet above the limestone would place the 41-inch coal at about the horizon of the High Splint coal.

On Middle fork of Collier Mr. Hodge reports the High Splint 54 inches thick with a thin parting 4 inches from the bottom. He places the coal at the latter place 90 feet higher than the same coal on the Right fork. At a point 280 feet higher, he reports another coal 3 feet to 3½ feet in thickness without parting. Three thin coals were found within an interval of 20 feet, the lowest one 170 feet above the High Splint.

The Taggart is again opened on the right of Left fork, ¼ mile up, at about the same elevation as that on Right fork. Two coals coming 20 and 43 feet respectively, below the Taggart, have been opened here but the openings were closed when visited. The following section shows the relation of the Taggart to the two lower coals at this place:

#### Taggart Coal.

Sandstone .....	15 ft.	} Taggart.
Shale .....	24"	
Coal, upper bench .....	41"	
Shale .....	9 ft.	
Coal, clean .....	16"	
Shale .....	½"	
Coal, hard semi-splint .....	15"	
Coal to water .....	6"	
Coal below water, reported .....	24"	
Sandstone .....	20 ft.	
Coal, reported .....	24"	}
Shale .....	15 ft.	
Coal, top exposed, reported .....	36"	
Massive sandstone .....	45 ft.	

The two lower coals shown in the above section are opened on the left of Left fork, ½ mile up. Barometric readings show an upstream dip from the forks to a point about ¾ the distance up Left fork, then a reverse dip to the head of the stream. The following section was made just above Winfield Scott's house and gives the thickness of the two thin coals below the Taggart.

#### Section Just Above Winfield Scott's House.

Sandstone with Taggart coal close above. ....	20 ft.
Coal .....	24 to 26"
Clay .....	12"
Siliceous shale .....	20 ft.
Coal .....	23"

Between the Taggart and the Low Splint coals are three coals which are opened on the left of Left fork of Collier, 1¼ miles from the forks. The relation of the Taggart to the Low Splint, with the intervening coals is shown in the following section:

## Section.

Black slate containing marine fossils.	
Coal .....	7"
Gray clay .....	} Low Splint ... 62"
Coal, top exposed, reported .....	
Elevation, 2020.	
Sandstone, massive .....	50 ft.
Shale .....	24"
Coal .....	30½"
Clay .....	1½"
Coal .....	12½"
Clay .....	½"
Bone and rash .....	1"
Coal, rashy on top .....	3½"
Dark shale .....	¾"
Hard clay floor.	
Shale .....	15 ft.
Coal, opening closed.	
Shale .....	10 ft.
Sandstone .....	15 ft.
Coal .....	20"
Black shale .....	1"
Coal .....	3"
Sandstone .....	35 ft.
Covered .....	70 ft.
Sandstone .....	15 ft.
Taggart coal.	

On the right, ½ mile up the right fork of Left fork, at an elevation of 3045 feet, an old opening, now closed, was found which is 200 feet too high for the High Splint. Only the top of the coal was visible and nothing was learned of its thickness.

One hundred yards up, on the left of the first right branch above Elkins branch of Poor fork, the Imboden coal shows the following section at the face of a ten-yard entry:

## LETCHER COUNTY

## Imboden Coal.

Shale .....	10 + ft.
Coal .....	7½"
Black shale .....	1"
Coal .....	3"
Splint .....	2"
Coal .....	36½"
Bone .....	¼"
Coal .....	1"
Mother coal .....	¼"
Coal .....	4"
Sulphur band .....	½"
Rashy coal .....	3½"
Hard coal .....	3"
Clay bottom.	

The coal in the entry dips 9°—S. 60° E.

## MAGGARD BRANCH.

The following section of the Imboden coal on the left of the branch, 500 feet from the river, at the face of a 20-yard entry, was given the writer by a representative of an eastern coal company:

## Imboden Coal.

Shale roof	
Coal, reported .....	12"
Coal, hard .....	21½"
Soft slate (clay or shale) .....	2½"
Coal, hard (perhaps splint) .....	8½"
Soft slate (clay or shale) .....	2"
Coal, hard .....	4½"
Bone .....	1"
Coal, soft .....	34"
Coal, soft, rashy .....	12"
Clay bottom.	

On the same branch Mr. Hodge reports a 15-inch coal, about 30 feet under the Imboden, which he describes as the Harlan coal, and another thin coal under black slate roof, 15 feet lower. This coal, which comes 30 feet below the Imboden coal, is persistent to the east and, together with a thin coal about the same distance above the main bed, serves to identify the Imboden as far up as the mouth of Smith creek.

## ROBERTS BRANCH.

The Imboden coal is opened on the left of this branch and  $\frac{1}{8}$  mile up from Poor fork. The following is a section of the coal at the face of a wet entry where the coal was rotten on the face. The dip here is  $10^\circ$  to the south-east.

## Imboden Coal.

Shale roof.	
Coal . . . . .	41"
Bone . . . . .	1 to 2"
Coal . . . . .	6½"
Bone . . . . .	4"
Clay . . . . .	1"
Coal . . . . .	33"
Bone . . . . .	½"
Coal . . . . .	5"
Rash . . . . .	5"
Coal in water . . . . .	7"

## STAGGERWEED HOLLOW.

The Imboden coal is exposed in the wagon road on the left side of Poor fork, opposite the mouth of Staggerweed hollow. It is standing at a high angle and dips a few feet below the foot of the hills on the south side of Poor fork.

One-fourth mile up the hollow, on the left, coal is opened at an elevation of 1794 feet above sea level. The following is a section at the mouth of the entry and continuing down the branch. From the interval down to the Imboden coal, the coal opened in Staggerweed hollow is evidently of the Collier bed.

## Section of Staggerweed Hollow.

Shale containing fern impressions. . . . .	20 ft.
Coal . . . . .	4½"
Semi-splint coal . . . . .	10¾"
Coal . . . . .	7½"
Splint coal . . . . .	2½"
Coal . . . . .	8¼"
Splint coal . . . . .	2½"
Coal . . . . .	6½"
Covered . . . . .	20 ft.
Massive sandstone . . . . .	75 ft.
Covered . . . . .	10 ft.
Massive sandstone . . . . .	30 ft.
Covered, estimated . . . . .	30 ft.
Shale, partly covered, estimated . . . . .	50 ft.

The Imboden coal is close beneath the base of the 50-foot interval of shale in the above section.

The same coal as that opened on Staggerweed hollow is again opened about 225 yards to the east, at elevation of 1800 feet. It here shows 38½ inches of solid coal with soft sandstone roof and clay bottom.

## JOE DAY BRANCH.

The Imboden coal is opened on the left of the branch a short distance above the mouth. The thickness of the coal is reported by the Blackwood Coal & Coke Company to be 59 inches.

The Collier coal is opened on the right of the middle fork of Joe Day branch at an elevation of 1785 feet. It contains 38½ inches of clean coal, under 8 feet of sandstone with clay bottom. Fifty-five feet below is a thin coal under 6 inches of black shale. The relation of the two coals is shown in the following section:

## Section on Middle Fork of Joe Day Branch.

Sandstone roof.	
Coal, Collier . . . . .	38½"
Covered, sandstone at bottom . . . . .	55 ft.
Black shale . . . . .	6"
Coal, 8 inches exposed, about. . . . .	24"
Massive sandstone close below.	

On the Left fork,  $\frac{1}{4}$  mile up, on the left of the trail, the Taggart coal has been opened by the Blackwood Coal & Coke Company, of Blackwood, Va., at an elevation of 1866 feet above sea level, and again,  $\frac{3}{4}$  mile due south, at an elevation of 1846. The following sections (No. 1 and No. 2) of these openings on Joe Day branch and two additional openings (No. 3 and No. 4) were supplied by the above mentioned company:

(1)	(2)
Taggart Coal.	Taggart Coal.
Coal . . . . . 21½"	Coal . . . . . 38"
Slate and coal . . . . . 17"	Slate and coal . . . . . 17"
Slate . . . . . 7½"	Slate . . . . . 5"
Coal . . . . . 5"	Bone coal . . . . . 4"
Slate . . . . . 4½"	Coal . . . . . 22"
Coal . . . . . 28½"	Slate . . . . . 13"
Slate . . . . . 5"	Coal . . . . . 25"
Coal . . . . . 26"	Elevation, 1846.
Elevation, 1866.	

The following section was made on the right of the branch, opposite No. 2:

(3)
Taggart Coal.
Coal . . . . . 33"
Slate . . . . . 4"
Coal . . . . . 5"
Slate . . . . . ½"
Coal . . . . . 8"
Slate and coal . . . . . 3"
Coal . . . . . 22"
Slate . . . . . 10"
Coal . . . . . 26"

Another section of the same coal on right of branch, about opposite No. 1:

(4)
Taggart Coal.
Coal . . . . . 38"
Slate and coal . . . . . 17"
Slate . . . . . 5"
Bone coal . . . . . 4"
Coal . . . . . 23"
Slate . . . . . 12"
Coal . . . . . 26"

One-fourth of a mile to the northeast of No. 1 and 15 feet higher, the following section was reported:

Taggart Coal.
Coal . . . . . 24"
Slate and coal . . . . . 15"
Slate . . . . . 5"
Coal . . . . . 6"
Slate . . . . . 3½"
Coal . . . . . 28½"
Slate . . . . . 5"
Coal . . . . . 26"

Mr. Straub's measurement of the strata on the left fork of the branch is as follows:

#### Section of Strata on Left Fork, Joe Day Branch.

Bench, perhaps place of Low Splint coal.	
Covered . . . . .	40 ft.
Sandstone . . . . .	30 ft.
Shale . . . . .	10 ft.
Sandstone . . . . .	5+ ft.
Covered, mostly shale . . . . .	15 ft.
Sandstone . . . . .	55 ft.
Shale in part . . . . .	20 ft.
Taggart coal, elevation, 1866 A. T.	
Covered . . . . .	10 ft.
Shaly sandstone . . . . .	15 ft.
Coal bloom.	
Shale . . . . .	3 ft.
Sandstone . . . . .	12 ft.
Covered . . . . .	10 ft.
Sandstone . . . . .	40 ft.
Covered, mostly shale . . . . .	40 ft.
Coal bloom . . . . .	} 8 ft.
Clay and shale . . . . .	
Coal bloom . . . . .	} 2 ft.
Shale . . . . .	
Massive sandstone . . . . .	8 ft.
Shale and covered . . . . .	25 ft.
Covered . . . . .	35 ft.
Sandstone . . . . .	45+ ft.

A coal, on the left, has been opened in a bed of shale beside the trail to Black mountain, with an interval of 525 feet above the Taggart coal. This is, perhaps, one of the split seams of the Pardee or Limestone coal. The actual interval between these two coals is somewhat greater

than that given above, due to the southeast dip of the measures.

Along the road on the left of Poor fork,  $\frac{1}{2}$  mile above Joe Day branch, the following excellent section of the rocks for 110 feet above and 214 feet below the Imboden coal, is exposed in the upturned edges of the strata. The Imboden coal was exposed on the sharp nose on the right of Poor fork, but the opening was closed at the time of the writer's visit to the place.

Section of Strata  $\frac{1}{2}$  Mile Above Joe Day Branch.

Sandstone, top not seen .....	30 ft.
Shale .....	50 ft.
Coal.....	Coal .. 10"
	Bone 1"
	Coal ... 4½"
	Clay and bone .. 1"
	Coal .. 13½"
Sandstone at top, shale below .....	30 ft.
Imboden coal.....	Coal . 50"
	Rash 2"
	Coal . 8"
Sandstone .....	2+ ft.
Shale .....	15 ft.
Coal .....	24"
Shaly sandstone .....	110 ft.
Massive sandstone .....	15 ft.
Black slate .....	4 ft.
Shaly sandstone .....	78 ft.
Shale .....	32 ft.

The Imboden coal was opened and the measurements given made by the Blackwood Coal & Coke Company. The same coal outcrops in the road,  $\frac{1}{4}$  mile to the east, where it is about 5 feet thick, but could not be accurately measured. The rocks dip 15°, S. 8° W. Here the thick coal is close above a sandstone.

The Imboden coal has been opened on the right of Poor fork, under 15 feet or more of shale and sandstone, at a point  $\frac{1}{2}$  mile below the mouth of Brown branch. No measurements of the coal could be made.

On the left,  $\frac{1}{4}$  mile up the first right branch of Poor fork below Brown branch, a coal with the following section occurs at an elevation of 1880 feet. This coal is about 275 feet higher than the Imboden coal, but the southeast dip would increase the interval to more than 300 feet. The position of the coal is that of the Taggart bed, but the section at the face of the coal is more like the Collier seam.

Section of Collier (?) Coal.

Sandy shale.	
Coal . . . . .	30"
Shale, dark . . . . .	4"
Coal . . . . .	2"
Shale below.	

In a prospect opening on the Imboden coal on the left of the road and 20 feet from it,  $\frac{1}{4}$  mile below Brown branch, the following section was obtained:

Imboden Coal.

Coal . . . . .	24"
Clay . . . . .	1"
Coal . . . . .	14"
Clay with some coal..	14"
Coal . . . . .	25"+

BROWN BRANCH.

A short distance above the mouth of Brown branch the rocks are dipping 21°, S. 20° E. Three hundred yards up the branch from the road, the Imboden coal is opened on the left of and about 10 feet above the branch. The following is a section at the face of a 30-yard entry. The dip of the coal is here only 10°.

Imboden Coal.

Shale . . . . .	10+ ft.
Coal . . . . .	18"
Shale, rashy . . . . .	¼ to ½"
Coal . . . . .	10"
Rashy coal and shale	4¾"
Coal, hard .....	4"
Soft clay . . . . .	½"
Coal and shale .....	5"
Coal, hard, clean.....	24½"
Clay floor.	

Another thin coal is reported about 20 feet under the Imboden and another 2 feet thick about 30 feet above. The latter has been opened at the mouth of the first right branch of the main stream.

Two coals have been opened on the second right branch of Brown branch,  $\frac{1}{2}$  mile up. The upper coal is 275 feet above the Imboden, but the opening is now closed and the coal entirely hidden. This is the same coal as that on the left of the first branch below Brown branch and is probably the Collier bed.

Fifty-five feet below is a coal having the following section at the mouth of a 2 yard entry. The dip between the two increases the interval to about 75 feet or more.

#### Upper Bench of Harlan Coal.

Sandstone .....	10+ ft.
Shale roof.	
Coal .....	5"
Black shale .....	2"
Coal .....	9"
Clay .....	$\frac{1}{2}$ "
Coal .....	19"+

#### OVEN FORK.

Three thin coals below the Imboden bed occur on Oven fork between the mouth and the big bend in the stream  $\frac{1}{4}$  mile up. The first coal below the Imboden occurs as a bloom 30 feet below and the second, as nearly as can be determined, on the sharp southeast dip of the rocks, is 268 feet below. The latter coal is opened in a bed of shales about 40 feet above a massive sandstone. The following is a section at the mouth of a wet entry. The dip here is  $10^{\circ}$ .

#### Coal East of and Opposite Mouth of Oven Fork.

Shale roof.	
Coal .....	14"
Clay .....	$1\frac{1}{2}$ "
Coal .....	6"
Clay floor.	

#### FRANKS CREEK.

The Imboden coal is opened on the left of Franks creek,  $\frac{1}{4}$  mile up, 10 feet above the bed of the creek, at an elevation of 1720 feet. At the mouth of the opening the entire bed is 86 inches, but it thins to the following section at face of a 10-yard entry, where a sample of the coal was taken for analysis:

#### Imboden Coal.

Shale roof.	
Cannel coal ....	2"
Soft coal .....	21"
Clay parting ....	2"
Soft coal ....	$11\frac{1}{2}$ "
Clay parting .....	36"
Coal, reported 29 ins...	12"+

In collecting the sample for analysis, the clay partings and the bottom coal were excluded. Following is the analysis of this coal:

#### Analysis of Imboden Coal.

Laboratory No. G-3711, Imboden coal, mouth of Franks Creek of Poor Fork.

Analysis—Per cent.	Air-dried	As Received
Moisture .....	1.08	1.51
Volatile combustible matter .....	34.15	34.00
Fixed carbon .....	56.35	56.11
Gray ash .....	8.42	8.38
Total .....	100.00	100.00
Sulphur .....	1.34	1.33
B. T. U. per pound .....	14,275.00	14,215.00
Specific gravity .....	1.322	
Moisture lost by air drying .....		.44

The same coal has been opened on the right of Smith creek, about  $\frac{1}{4}$  mile above the mouth of Franks creek, where the following section was obtained at the mouth of a newly opened bank:



## Imboden Coal.

Sandstone	10+ ft.
Rashy coal	3"
Coal	14"
Clay	1½"
Coal	14"
Clay	6"
Black slate	3½"
Coal	3"
Black slate	3½"
Clay	3"
Coal	1½"
Clay	13"
Coal	2"
Clay	2"
Coal	22"
Clay bottom.	

The bottom of the bed is 5 feet above the creek bed with a massive sandstone below. Coal dipping to south-east.

The Kelly coal has been opened on the left of Franks creek a short distance above the Imboden bank, but the opening was entirely closed when visited. The vertical interval above the Imboden, as calculated on the dip, is 70 feet. Between the Kelly opening and the Harlan coal opened near the forks of Franks creek, is a coarse grained, massive sandstone 80 feet in thickness. Small grains of red hematite are conspicuous in the sandstone. The Harlan coal comes close above the top of this massive sandstone.

The Harlan coal in this region is a double coal with an interval between the two benches of 15 to 20 feet of sandstone. The lower bench is the one most generally opened for local use. The lower bench, in all of the region from Pound river, Virginia, to and including Smith creek, has a black slate roof with sandstone above. On Franks creek in the two openings where the coal has been explored the black slate is cut out by the overlying sandstone.

One-fourth of a mile below the forks of Franks creek, on the right, the lower bench of the Harlan coal has been opened, and shows the following at the mouth of a wet entry.

## Harlan Coal.

Sandstone roof.	
Coal	5½"
Splint	10½"
Coal	12"
Splint	8"
Clay bottom.	
Elevation, 1860.	

The same coal is opened on the left of Franks creek, 100 yards below the forks. The following is a section at the face of a 30-yard entry where a sample of the coal was collected for analysis:

## Harlan Coal.

Sandstone roof.	
Hard semi-splint	19"
Coal	18"
Clay bottom.	

The following is the analysis made from this bed:

## Analysis of Harlan Coal.

Laboratory No. G-3710, lower bench of Harlan coal, forks of Franks Creek of Poor Fork.

Analysis—Per cent.		Air-dried	As Received
Moisture	.....	1.01	1.37
Volatile combustible matter	.....	36.43	36.30
Fixed carbon	.....	57.73	57.52
Lilac ash	.....	4.83	4.81
Total	.....	100.00	100.00
Sulphur	.....	.92	.92
B. T. U. per pound	.....	13,400.00	13,350.00
Specific gravity	.....	1.300	
Moisture lost by air drying	.....		.37

The upper bench has been opened 15 feet above the lower bed but the opening was completely closed when visited.

At Mr. M. Collier's house, on the right of Right fork ¼ mile up, the Collier or "Twin seam" has been opened. The two beds are 20 feet apart with shale be-

tween. The lower bed occurs close above the top of a massive sandstone which extends down to the upper bed of the Harlan coal. The elevation of the lower bed is 1920 feet above sea level. Mr. Collier who opened the two coals reports the lower bench 2 feet thick and the upper bench slightly thinner.

Just back of Mr. Collier's house, on the right of a right drain, the Taggart coal has been opened. The following is a section at the face of a 10-yard entry:

#### Taggart Coal.

1. Black slate roof.
  2. Coal .....11"
  3. Clay and coal.... 5"
  4. Hard coal ..... 6"
  5. Splint . . . . . 1"
  6. Coal . . . . . 6"
  7. Splint . . . . . 3"
  8. Clay . . . . . 7"
  9. Coal . . . . . 13½"
  10. Clay
- Elevation, 2015.

Two inches of clay with 4 inches more coal below, are reported by Mr. Collier. The following analysis was made from this coal. Nos. 3 and 8 of the section were excluded from the sample.

#### Analysis of Taggart Coal.

Laboratory No. G-3709, Taggart coal, near head of Franks Creek of Poor Fork.

Analysis—Per cent.	Air-dried	As Received
Moisture .....	.92	1.38
Volatile combustible matter .....	36.94	36.77
Fixed carbon .....	56.72	56.46
Light buff ash .....	5.42	5.39
Total ..	100.00	100.00
Sulphur .....	.73	.73
B. T. U. per pound.....	14,440.00	14,370.00
Specific gravity .....	1.298	
Moisture lost by air drying.....		.46

On the right of Right fork, ½ mile above the forks, a coal which is 45 feet below the Taggart coal shows 26 inches of clean coal. The interval between this and the Taggart is a massive sandstone.

A general section from the head of Right fork down to the horizon of the Harlan coal just below the forks, shows the relation of some of the coals from the Harlan to the fossiliferous limestone above the Pardee or Limestone coal. In this section no allowance is made for dip, which, according to the elevations of the Blackwood Coal & Coke Company on the Pardee coal on this stream, is to the northwest at the rate of 25 to 30 feet to the mile. The upstream dip would be somewhat less.

#### Section on Right Fork, Franks Creek.

Shale	45 ft.
Fossiliferous limestone.	
Shale	15 ft.
Coal bloom.	
Sandstone with fragments of coal and prominent bench just below	50 ft.
(Perhaps place of Pardee coal.)	
Covered	225 ft.
Shaly sandstone	25 ft.
Coal . . . . .	12½"
Shale . . . . .	½"
Coal . . . . .	½"
Coal.. Shale . . . . .	2"
Coal . . . . .	13"
Clay . . . . .	½"
Coal . . . . .	9"
Covered	120 ft.
Shale	25 ft.
Coal bloom, place of Dean coal.	
Sandstone, massive at top, covered below....	240 ft.
Coal, Taggart.	
Sandstone, massive in upper part . . . . .	45 ft.
Coal . . . . .	26"
Covered	50 ft.
Coal....	
Shale. } Collier beds . . . . .	20 ft.
Coal....	
Sandstone interval . . . . .	80 ft.
Harlan coal—Upper bench.	
Sandstone . . . . .	15 ft.
Harlan coal—Lower bench.	

On the lower part of Franks creek the southeast dip is 100 feet or more in 1000 feet, but it flattens rapidly and ceases entirely at a point about half way from the mouth to the forks.

The Taggart coal is opened on the left of Left fork just below the mouth of Trace fork, with section as follows:

#### Taggart Coal.

Shale.	
Cannel slate .	3½"
Bone .	2½"
Coal	15½"
Clay containing 2 coal bands.....	6"
Coal . . . . .	17"
Clay . . . . .	8"
Coal . . . . .	3½"
Clay.	
Elevation, 2075.	

On the left of the public road to Stonega, Va., between Little fork and Trace fork, the Taggart coal is again opened, at an elevation of 2115 feet, and shows the following section:

#### Taggart Coal.

Sandstone bands in shale .	10 ft.	} Taggart.
Black slate .	15"	
Coal . . . . .	17"	
Clay parting with 2 bands of coal . . .	6"	
Coal . . . . .	20"+	
Cross-bedded sandstone . . . . .	20 ft.	
Shale, siliceous . . . . .	25 ft.	
Coal, cropping in road, about.....	18"	

The following is a section of the strata exposed along the Eolia and Stonega road on the north side of Black mountain. Elevation of the gap, 3305 above sea level:

#### Section on North Side of Black Mountain.

Sandstone . . . . .	10 ft.
Covered . . . . .	20 ft.
Calcareous sandstone . . . . .	20 ft.
Shale . . . . .	30 ft.
Coal crop, place of High Splint, about	4 ft.
Sandstone . . . . .	90 ft.
Old coal opening now closed, Cornett coal.	
Covered, sandstone in center . . . . .	80 ft.
Sandstone . . . . .	10 ft.
Covered . . . . .	15 ft.
Shale . . . . .	35 ft.
Covered . . . . .	20 ft.
Shale . . . . .	25 ft.
Sandstone . . . . .	10 ft.
Covered . . . . .	15 ft.
Shale and sandstone . . . . .	40 ft.
Massive sandstone . . . . .	30 ft.
Covered . . . . .	5 ft.
Sandstone . . . . .	35 ft.
Covered, shale in center . . . . .	65 ft.
Sandstone . . . . .	40 ft.
Shale . . . . .	35 ft.
Covered . . . . .	40 ft.
Coal crop.	
Shale and sandstone . . . . .	35 ft.
Coal crop, place of Dean coal.	
Shale and sandstone . . . . .	35 ft.
Covered . . . . .	10 ft.
Coal crop.	
Sandstone and shale . . . . .	65 ft.
Black shale . . . . .	25 ft.
Coal stain.	
Covered . . . . .	65 ft.
Coal, place of Low Splint.	
Sandstone . . . . .	85 ft.
Shale . . . . .	35 ft.
Covered, perhaps all shale . . . . .	25 ft.
Sandstone . . . . .	45 ft.
Sandy shale . . . . .	25 ft.
Coal, Taggart.	
Sandstone . . . . .	20 ft.
Shale . . . . .	25 ft.
Coal.	

On the south side of Black mountain at the head of Roaring fork of Powell river, the Blackwood Coal & Coke Company is operating a mine on the Pardee or Limestone coal. The opening has been driven through the mountain to the Kentucky side. The elevation of the coal at the mouth of the mine is 2872 feet. A large part of the coal from this mine comes from the Kentucky side and entries are now being driven under Little fork ridge between Smith and Franks creeks. The coal where opened presents a magnificent face of 10 feet or more, with two thin partings near the top. Less than 1 mile to the west the bed separates into two or more benches. On the north side of Little fork ridge a parting near the center also separates the bed into two benches. The following is a section of the coal at the face 4000 feet in from the mouth of the mine:

Pardee Coal in Pardee Mine.		
Sandstone roof.		
1. Coal .....	5"	
2. Clay parting .....	3"	
3. Coal .....	5½"	
4. Bone .....	½"	
5. Coal, hard .....	40½"	
6. Bone slate .....	½"	
7. Coal, hard .....	45"	
8. Soft coal, rashy .....	2"	
9. Soft coal .....	15"	
10. Clay floor.		

A sample of coal collected from where the above section was measured gave the following results, with No. 2 excluded from the sample.

Analysis of Pardee Coal.		
Laboratory No. G-3708, Pardee coal, Pardee, Va.		
Analysis—Per cent.	Air-dried	As Received
Moisture .....	.99	1.26
Volatile combustible matter .....	35.66	35.57
Fixed carbon .....	56.98	56.82
Gray ash .....	6.37	6.35
Total .....	100.00	100.00
Sulphur .....	1.14	1.14
B. T. U. per pound .....	14,150.00	14,110.00
Specific gravity .....	1.315	
Moisture lost by air drying. ....		.27

The same company opened and operated for a while the High Splint coal, which is 321 feet above the opening on the Pardee coal. The main entry of the High Splint was also driven to cover on the Kentucky side of Black mountain. The following is a section of the coal on the face of entry about 1000 feet in:

#### High Splint Coal at Pardee Mine.

Shale roof.	
Soft coal .....	12"
Splint and semi-splint .....	55"
Clay bottom.	

A sample of coal from the above gave the following analysis:

#### Analysis of High Splint Coal.

Laboratory No. G-3707, High Splint coal, Pardee, Va.		
Analysis—Per cent.	Air-dried	As Received
Moisture .....	1.08	1.30
Volatile combustible matter .....	36.48	36.40
Fixed carbon .....	58.13	58.00
Light buff ash .....	4.31	4.30
Total .....	100.00	100.00
Sulphur .....	.67	.67
B. T. U. per pound.....	14,840.00	14,800.00
Specific gravity .....	1.308	
Moisture lost by air drying. ....		.23

A general section at the Pardee mine shows the following relation and intervals from the Taggart to the top of the mountain, 215 feet above the High Splint:

## Section at Pardee Mine.

Flaggy sandstone .....	100 ft.
Shale at top and bottom.....	40 ft.
Coal crop.	
Shale at top and bottom.....	15 ft.
Massive sandstone .....	5 ft.
Shale .....	15 ft.
Massive sandstone containing quartz pebbles and plant impressions near the center	35 ft.
Calcareous sandstone .....	10 (?) ft.
Shale .....	30 ft.
High Splint coal .....	4 ft.
Covered interval .....	321 ft.
Pardee coal .....	10 ft.
Sandstone with shale at top .....	12 ft.
Coal, in three bands .....	1 ft.
Covered interval .....	200 ft.
Dean coal showing flint fire-clay parting.	
Covered interval .....	400 ft.
Taggart coal	Shale roof.
	Cannel slate .. 3"
	Splint .. 1¾"
	Coal .. 15½"
	Clay .. 2¾"
	Coal .. 14½"
	Clay .. 4"
	Coal .. 11¾"
	Clay bottom.

## SMITH CREEK.

The southeast dip which is so marked at Eolia and at the mouth of Franks creek, continues up Smith creek for a distance of 4-5 of a mile to a point where the stream makes a sharp bend to the east. This point is in the bottom of the main trough or syncline between Black and Pine mountains. Above this point is a low anticline with a second syncline between it and the foot of Black mountain, with the axis of the second syncline about at the mouth of Bee branch of Smith creek or above.

The Imboden coal goes under cover about ¼ mile above the mouth of Franks creek. On the first left branch of Smith creek the coal has been opened in a number of places. These openings show the coal split into two benches. On the right of this branch, near the mouth,

the upper bench is 55 inches above the bottom bench. At the head of this branch the two benches are about 15 feet apart.

The Kelly coal outcrops in the road about ½ mile above the mouth of Franks creek.

On the left of the third right branch, 1 mile from Eolia, the Harlan coal is opened in two places with the following section. The black slate roof found here is likewise characteristic of this coal on Roberts branch at the head of Poor fork, and on South fork of Pound river in Virginia.

## Harlan Coal.

Sandstone .....	8+ ft.
Black, fissile slate.....	2 ft.
Clay .....	1"
Bone coal .....	3"
Clay .....	3"
Coal .....	9"
Sandstone .....	½"
Coal .....	2"
Clay bottom.	
Elevation, 1860.	

One hundred yards to the east the same coal is opened with the following measured section:

## Section.

Harlan coal.....	Sandstone .....	5 ft.
	Hard, black, fissile slate	30"
	Coal ..	14"
	Dark shale ..	¼"
	Coal ..	1½"
	Clay parting ..	2 to 5"
	Coal ..	11½"
	Clay bottom ..	12"
	Sandstone ..	2 ft.
	Sandy shale ..	8 ft.
	Massive sandstone ..	80 ft.
	Shale, containing Kelly coal.	20 ft.
	Sandstone to Imboden coal.	40 ft.

The north point of Little fork ridge at the head of this branch, is called "Bunker Hill." On this hill the Dean or Fire-clay coal shows the following section at the face of an old entry:

## Dean Coal.

Sandstone.	
Shale .. .	24"
Coal .. .	¾"
Shale .. .	½"
Coal .. .	1"
Clay .. .	1"
Shale .. .	1"
Coal .. .	2"
"Black-jack" .. .	4"
Flint fire-clay, chocolate color .. .	3 to 4½"
Coal .. .	1¾"
Clay .. .	½"
Splint coal .. .	10½"
Coal .. .	8"
Clay bottom.	
Elevation, 2440.	

The Pardee coal is opened at the head of a ravine ¼ mile to the southeast of the above. The following section, at the mouth of a prospect opening on the coal, shows the separation of the coal here into two benches:

## Pardee Coal.

Sandstone.	
Shale .. .	5 ft.
Coal .. .	66"
Clay .. .	23½"
Coal .. .	39"

What is perhaps the Collier or Twin seam, is opened on the left of a right branch 1½ miles from Eolia. The following is a section of the two benches with interval between:

## Section of Collier Coal.

Sandstone .. .	10+ ft.
Coal, upper bench ..	21"
Shale .. .	25 ft.
Coal .. .	24"
Clay .. .	lower bench 1½"
Coal .. .	3"
Clay bottom.	
Elevation, 2010.	

Ninety feet below is the top of a massive sandstone which marks the horizon of the Harlan coal.

The Taggart coal was opened on the first left drain of Smith creek below Bee branch, by the Blackwood Coal & Coke Company, at an elevation of 2160 feet. The opening was completely closed when visited by the writer.

The same coal is now opened on left of the main creek, opposite the mouth of the right fork, where the trail leads over Black mountain, at an elevation of 2135 feet. The following is a section of the coal and the hillside below:

## Section.

Massive sandstone .. .	20+ ft.
Shale .. .	10 ft.
Cannel slate. } .. .	1½"
Coal .. .	Taggart coal 14¼"
Clay .. .	3½"
Coal .. .	23"
Clay floor.	
Sandstone .. .	35 ft.
Coal crop.	

The Collier coal is opened on the left of Bee branch, 200 yards up and 100 feet below an old opening on the Taggart coal, and shows the following section:

## Collier Coal.

Sandstone.	
Dark shale .. .	24"
Gray shale roof.	
Coal .. .	8"
Black shale parting .. .	¼"
Coal .. .	23½"
Black shale rash.	

The Low Splint coal was opened by the Blackwood Coal & Coke Company, on the left of the first left branch above Bee branch, with section given below:



## Low Splint Coal.

Coal ..	5"
Shale ..	13"
Coal .....	2"
Shale ..	5"
Coal ..	9"
Clay ...	1"
Coal, bottom not seen .....	12"
Elevation, 2290.	

## MEADOW BRANCH.

The measures at the mouth of this branch show a southward dip of about 10°, which gradually flattens to 5° at a point 850 feet from the mouth. At the latter place a coal has been opened on the left of, and 15 feet above the stream bed, with the following section. This is one of the coals which comes below the Imboden coal:

## Coal Near Mouth of Meadow Branch.

Shale, siliceous. ..	5+ ft.
Coal .....	1"
Black shale .....	¼"
Coal, soft .....	19"
Clay parting .....	3"
Coal .....	6"
Shale .....	3"
Coal .....	2"
Clay bottom .....	4"
Sandstone.	

A coal reported to be 37 inches in thickness, under 5 feet of shale, with massive sandstone 50 feet thick above that, was opened 200 yards below the forks at an elevation of 1865 feet.

What appears to be the lower bench of the Harlan coal has been opened on the left of the right fork, ½ mile up, with section given below. The dip here is 5°, S. 20° W.

## Harlan Coal.

Sandstone ..	15+ ft.
Coal, reported ..	?
Sandstone ..	20 ft.
Shale ..	30"
Coal ..	13"
Clay ..	2"
Coal ..	26"
Elevation, 1948.	

The Collier coals are opened on the left of a right branch of Left fork, opposite the store. The dip here is still to the south.

## Collier Coal.

Shale.	
Coal ..	15"
Shale with plant im- pressions ..	82"
Coal ..	5"
Shale ..	1½"
Coal ..	4"
Shale ..	5½"
Coal ..	5"
Bone ..	11½"
Coal ..	7"
Rash ..	1"
Coal ..	3"
Clay ..	¾"
Coal ..	13"
Bone ..	1½"
Shale, siliceous ..	20 ft.
Coal ..	29½"
Black shale ..	2"
Coal ..	26"
Elevation, 2040.	

The Kelly coal has been exposed in a prospect opening on the right of the branch, one-half of the distance from the store to the opening on the Collier coal and 80 to 90 feet below, with following section:

## Kelly Coal.

Sandstone.	
Shale .....	6"
Coal .....	22"
Clay .....	1"
Coal .....	1½"
Clay .....	4"
Coal .....	4½"
Clay .....	60"
Coal .....	18"

On the left of a left branch ½ mile above the mouth of Meadow branch, and 200 yards from Poor fork, one of the lowest coals worked in Letcher County south of Pine mountain shows the following section at the face of a country bank. Dip 10°, S. 60°-70° W.

## Coal on Poor Fork ½ Mile Above Meadow Branch.

Sandstone .....	7 ft.
Coal .....	29"-33"
Shale bottom.	

On the right of the public road, opposite and ¼ mile south of the mouth of Pine branch, at Henry Mullin's house, one of the lower coals is opened for local use. It lies at the top of a massive sandstone 50 to 60 feet in thickness and dips to the south at an angle of 6°.

## Coal at Henry Mullin's House.

Sandstone .....	30 ft.
Shale .....	10 ft.
Coal .....	20"-22"
Sandstone bottom.	

## ROBERTS BRANCH.

The Harlan, the Collier, and the Taggart coals are all exposed on Roberts branch, but the strong southward dip and poor exposures of the intervening strata make it impossible to measure the intervals between them.

The Imboden coal is opened on the left, ½ mile up, where the strata are dipping 5°, S. 50° E.

## Imboden Coal.

Shale.	
Coal .....	3"
Clay .....	13"
Coal .....	35"
Shale bottom.	

On the right, 1 mile up, the Harlan coal is opened at Dave Sturgill's house.

## Harlan Coal.

Shale.	
Coal, upper bench .	36"
Sandstone .	13 ft.
Black slate .....	7 ft.
Coal, lower bench ..	42"
Shale bottom.	
Elevation, 2215.	

Another section of the lower bench 200 yards to the east, gives the following:

## Lower Bench of Harlan Coal.

Black slate.	
Coal .....	43"
Rashy coal .....	1½"
Shale .....	¾"
Rashy coal .....	1½"
Clay floor.	

The Collier coal, at a closed opening 75 feet above the Harlan bed, is reported 36 inches thick. The south-east dip will increase the interval to about 100 feet.

The Taggart coal, on the right of a branch which enters Roberts branch at Sturgill's house, is opened with following section:

## Taggart Coal.

Sandstone.	
Shale .. .	30"
Coal .. .	30"
Clay parting ....	6"
Coal, reported .	30"
Elevation, 2390.	

Just across the hill, on the South Fork of Pound river, in Virginia, the coals with intervening strata from the Taggart to 331 feet below the Imboden coal, were measured as given in the section below. The strata below the Imboden were measured along the road from Flat Gap P. O. to South fork of Pound river, along the up-turned edges of the strata, so that the measurements are only approximately correct.

## Section on South Fork, Pound River, Va.

Taggart coal.....	Coal . . . . .	36"	
	Clay . . . . .	2"	
	Coal . . . . .	12"	
	Clay . . . . .	2"	
	Coal . . . . .	12"	
Shale containing thin coal.....			20 ft.
Sandstone .....			60 ft.
Covered .....			30 ft.
Collier coal.....	Coal . . . . .	36"	
	Shale . . . . .	60"	
	Coal . . . . .	28"	
	Clay . . . . .	1/4"	
	Coal . . . . .	3"	
Sandstone .....			66 ft.
Harlan coal.....	Coal . . . . .	35 1/2"	
	Shaly ss. ....	188"	
	Black slate roof.		
	Coal .....	36"	
Sandstone, massive in middle and upper part, shale at bottom .....			150 ft.
Imboden coal, Upper bench.....	Coal . . . . .	15 1/2"	
	Bone . . . . .	1/4"	
	Coal . . . . .	4"	
	Bone . . . . .	3"	
	Coal . . . . .	12"	
Shale . . . . .			20 ft.
Sandstone .....			10 ft.
Imboden coal, Lower bench.....	Coal . . . . .	4"	
	Clay . . . . .	5 1/2"	
	Coal . . . . .	16 1/2"	
	Black shale . . . .	1"	
	Coal . . . . .	18 1/2"	
Shale . . . . .			5 ft.
Sandstone . . . . .			50 ft.
Shale . . . . .			30 ft.
Coal . . . . .			thin
Shale . . . . .			11 ft
Coal . . . . .			thin
Sandstone . . . . .			26 ft.
Coal . . . . .			thin
Sandstone on top, covered below. . . . .			14 ft.
Coal . . . . .			thin
Sandstone on top, covered below . . . . .			24 ft.
Coal . . . . .			thin
Shale . . . . .			11 ft.
Sandstone . . . . .			15 ft.
Shale . . . . .			95 ft.
Massive sandstone, perhaps . . . . .			50 ft.

## REGION NORTHWEST OF PINE MOUNTAIN.

## GENERAL SECTION.

That part of Letcher County lying north of Pine mountain is drained principally by the waters of North fork of Kentucky river, with a small portion in the north-east corner by the waters of Big Sandy river.

A detailed description of the coals of the North fork waters will be taken up first, followed by a description of those on the Big Sandy waters.

## NORTH FORK OF KENTUCKY RIVER.

## BULL CREEK.

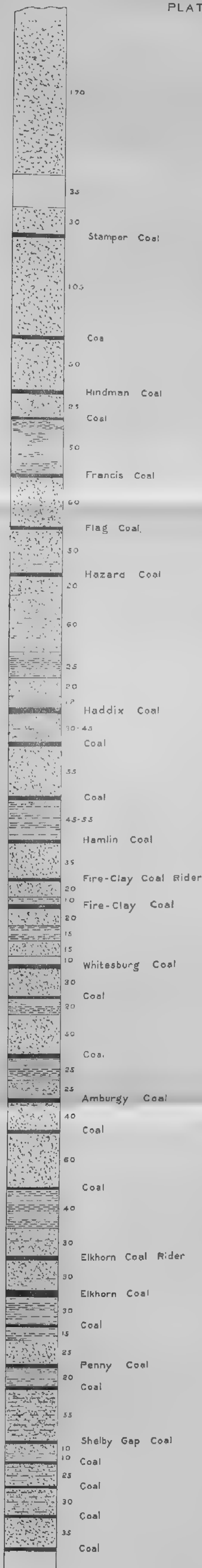
Only that part of Bull creek above Lick fork is in Letcher County, the stream entering North fork about two miles below the western boundary of the county.

The Fire-clay coal outcrops at mouth of Lick fork at an elevation of 1215 feet and goes below drainage  $\frac{1}{4}$  mile above. On the right of the creek,  $\frac{1}{8}$  mile below Lick fork, the coal is opened on the side of the road. The coal is too thin for commercial use at present but is worked for local consumption.

## Fire-clay Coal.

Coal .....	3"
Shale .....	24"
Coal .....	1"
Soft shale .....	36"
Hard, slaty shale ..	36"
Coal .....	25"
Splint .....	6"
Flint fire-clay .....	4"
Coal .....	?

The Hazard coal is opened on the left of Bull creek, just below the mouth of Lick fork, at an elevation of 1528 feet, or 315 feet above the Fire-clay coal at the mouth of Lick fork. The actual interval between the two is some what greater, due to the northwest dip. There is a massive sandstone above and one below the coal. The coal is badly cut up with partings, as shown by the following section:



GENERAL SECTION NORTH OF PINE MOUNTAIN

Hazard Coal.

Sandstone.	
Coal	4½"
Shale	3"
Coal	5"
Splint	2"
Coal	8"
Siliceous clay, hard	5"
Coal	4"
Siliceous, clay hard	12"
Sandstone.	

A prominent bench 120 feet below, perhaps marks the location of the Haddix coal.

One mile up Lick fork, on the left, the Francis coal has been opened at an elevation of 1588 feet. The coal has a shale roof, with a massive, cliff forming sandstone 35 feet thick above, and a massive sandstone below 30 feet thick. The latter weathers white on the face, due to a fungus growth. It is composed of large, white grains of quartz cemented into a very resistant rock. Near the middle of the sandstone are small, rounded, quartz pebbles which are not found in the sandstone above the Young coal. Only the top of the coal was exposed in the old opening. It is a hard, bright looking coal and is reported to be 3 feet thick.

The northwest dip of the measures here will increase the interval from the Francis coal to the Fire-clay coal from the elevations given above.

LICK BRANCH.

On the right of the first left branch of Lick branch, the mouth of which is just above Arminia, a coal is opened at an elevation of 1535 feet. Fifty feet above the coal is the base of a massive, cliff forming sandstone 30 feet or more in thickness. The coal is of the Hazard bed.



## Hazard Coal.

Shale .....	48"
Coal .....	4"
Clay .....	6"
Coal .....	4"
Bone .....	5"
Coal .....	12"+
Hard, siliceous clay bottom.	
Elevation, 1535.	

The thin coal which comes 30 to 45 feet below the Haddix coal, is exposed in the bed of Lick branch,  $\frac{1}{4}$  mile up, at an elevation of 1370 feet. About 2 feet of coal is exposed, the lower 6 inches splint.

On the left of a left branch, 1 mile up Lick branch, the Francis coal is opened as follows:

## Francis Coal.

Sandstone.	
Coal .....	13"
Shale .....	1"
Coal .....	2"
Clay .....	12½"
Black shale .....	3½"
Blue clay .....	28"
Coal .....	44"
Elevation, 1600.	

Seventy-five feet above, on same hillside, with a massive sandstone interval between, the Hindman coal has been opened but only 1 foot of clean hard coal was seen. It is reported to be 4 feet 4 inches thick. The bloom of a rider occurs in the soil 10 feet above, but may have slipped down.

## MEADOW BRANCH.

On the left of Meadow branch, 1 mile from the mouth, the Hindman coal is opened at an elevation of 1700 feet. The following section was made at the face of an 8-yard entry:

## Hindman Coal.

Massive sandstone.	
Coal .....	14"
Clay .....	½"
Coal .....	1½"
Clay .....	5"
Coal .....	40½"
Elevation, 1700.	

The same coal has been opened on the opposite side of the hill, on the Montgomery creek waters, with the following bed section:

## Hindman Coal.

Sandstone.	
Coal .....	14½"
Clay .....	½"
Coal .....	1½"
Clay .....	1¾"
Coal .....	42"
Elevation, 1685.	

The same coal is opened again on the right of Little Meadow branch, as given below:

## Hindman Coal.

Soft, yellow to gray sandstone.	
Coal .....	15"
Clay, with 1 inch coal near the center...	25½"
Coal .....	39"
Elevation, 1745.	

Fifty feet below, in the branch, a coal reported to be 30 inches thick has been opened but only the top of the coal was seen.

A coal opening on the right of Bull creek,  $\frac{1}{8}$  mile from the county line, shows the following section at the face of a 10-yard entry:

## Hindman Coal.

Sandstone.	
Coal .....	17"
Clay, with 1 inch coal near the center .....	22½"
Coal, bottom not seen .....	36"
Elevation, 1765.	

Above the coal is a brown weathering, coarse sandstone containing some mica and 40 feet or more in thickness. It weathers readily and does not here form steep cliffs like the sandstone the top of which is 90 feet below. The lower sandstone is a massive, cliff-forming sandstone which breaks off in huge boulders that work down the hillsides. In places it contains small, well worn, quartz pebbles.

The Hindman coal occurs high in the ridges on Bull creek and has a limited area of workable coal. On the headwaters of the creek it is the coal most generally mined for domestic use.

#### LINE FORK.

Line fork enters North fork at the western border of Letcher County. The ridge between the waters of Line fork and Leatherwood, around to the head of the former at Pine mountain, forms the county line between Letcher and Perry counties.

At the mouth of Line fork the Fire-clay coal is at an elevation of about 1207 feet, or 257 feet above Kentucky river. Near the mouth of Dry fork of Line fork,  $9\frac{1}{4}$  miles on a direct line to the southeast, it is at an elevation of 1650 feet, a total fall of 443 feet, giving a northwest dip of about 48 feet to the mile.

One half mile up Line fork, on the left, the Fire-clay coal as measured by Mr. Straub, gave the following section:

#### Fire-clay Coal.

Sandstone.	
Shale . . . . .	12"
Coal . . . . .	21"
Splint . . . . .	11½"
Flint, fire-clay . . . . .	5½"
Coal . . . . .	6"
Black, bituminous shale . . . . .	7½"
Coal . . . . .	1½"
Shale . . . . .	4"
Coal . . . . .	7"
Shale . . . . .	3"
Clay bottom.	
Elevation, 1207.	

A thin coal, about 250 feet below the Fire-clay coal, is exposed at the mouth of Line fork. The following is a section of the bluff made by the stream:

#### Section at Mouth of Line Fork.

Sandstone . . . . .	15 ft.
Shale, containing 12 inches of coal . . . . .	5 ft.
Massive sandstone . . . . .	30 ft.
Coal . . . . .	1 ft.
Clay . . . . .	1 ft.
Thin bedded, slaty sandstone and shale . . . . .	10 ft.

At the mouth of Bear branch,  $\frac{3}{4}$  mile up Line fork, is a bed of aluminous shales 35 feet thick, underlying sandstone and with large "cartwheel" concretions 15 feet from the top. A thin coal occurs at the top of the shales. The base of the shales is about 300 feet below the Fire-clay coal. There is an up stream rise of the strata at this place about equal to the fall of the main stream.

At the big bend  $\frac{1}{2}$  mile above the mouth of Bear branch, the thin coal at the top of the shales is 35 feet above the bed of the creek. There is still another thin coal 30 feet above the one at the top of the shales, as shown in the following section at this place.

#### Section $\frac{1}{2}$ Mile Above the Mouth of Bear Branch.

Sandstone.	
Coal . . . . .	15"
Shale . . . . .	5 ft.
Massive sandstone . . . . .	25 ft.
Coal . . . . .	14"
Slaty sandstone . . . . .	10 ft.
Shales, "Bee Tree" . . . . .	25 ft.

Local folding is shown in the Bee Tree shales, some of the folds being pronounced, others slight. One occurs at the mouth of the second branch on the left below Campbell branch and another one just below the mouth of the latter stream.

#### CAMPBELL BRANCH.

One-half mile up Campbell branch, on the left, the Fire-clay coal is opened at an elevation of 1325 feet. The following is a section of the coal.

Fire-clay Coal.	
Sandstone.	
Coal .....	32"
Flint fire-clay .....	5"

A pronounced bench 45 feet below, marks the place of the Whitesburg coal.

The Fire-clay coal is opened again on the right of the left fork 100 yards up. The following is a section at the mouth of the entry.

Fire-clay Coal.	
Massive sandstone .....	30 ft.
Sandy shale .....	8"
Coal, hard .....	7"
Coal, rashy .....	1"
Coal, hard .....	23"
Flint fire-clay .....	4"
Clay with plant impressions, becoming more sandy below.	
Elevation 1336.	

The section was continued down the branch from the above opening with the following:

Sandstone .....	37 ft.
Covered .....	5 ft.
Bloom of Whitesburg coal.	
Sandy shale .....	10 ft.
Sandstone .....	40 ft.
Shale .....	15 ft.
Black shale .....	6"
Coal, with shale partings .....	12"
Clay .....	12"
Shale .....	18"
Sandstone .....	55"
Shale .....	75 ft.
Massive sandstone .....	70 ft.
Sandstone containing ferruginous concretions .....	4 ft.
Shale .....	6"
Coal .....	8-12"
Shales, "Bee Tree" .....	45 ft.

## LONG BRANCH.

Two openings on the Fire-clay coal are reported on Long branch by Mr. Straub. The first is on the left  $\frac{3}{4}$  mile up with following section:

Fire-clay Coal.	
Shale .....	5+ ft.
Coal .....	3"
Clay, containing iron concretions. ....	15"
Coal .....	36"
Flint fire-clay .....	3½"
Soft clay.	
Elevation 1346.	

One-quarter of a mile further up, on the left, another opening shows the following section:

Fire-clay Coal.	
Shale .....	4 ft. +
Coal .....	3"
Shale .....	36"
Coal .....	30"
Black shale .....	2"
Coal .....	6½"
Flint fire-clay.	
Elevation, 1361.	

## SALTICK BRANCH.

The second coal above the top of the Bee Tree shales, as shown in the section  $\frac{1}{2}$  mile above the mouth of Bear branch, has been opened on the left of Saltlick branch. The following section on the latter branch shows the relation to the Bee Tree shales.

Section on Saltlick Branch.	
Massive sandstone.	
Slate .....	24"
Cannel coal .....	1½"
Coal and bone .....	4"
Coal, clean .....	1"
Dark shale .....	4"
Bituminous coal .....	18"
Shale .....	24"
Massive sandstone .....	25 ft.
Coal .....	12"
Shaly sandstone on top grading down into the Bee Tree shales to water level of Line fork...	
32 ft.	

## TURKEY CREEK.

About 100 yards up Left fork of Bates fork of Turkey creek, the Amburgy coal with its characteristic marine fossils in the black shale roof has been opened at an elevation of 1155 feet. The coal is reported to be 18 inches thick. The Fire-clay coal is opened on the left of Left fork of Bates fork  $\frac{1}{4}$  mile up with section given below.

## Fire-clay Coal.

Sandstone . . .	5 ft. +
Shale . . . . .	4 ft.
Coal . . . . .	3 ft.
Flint fire-clay . . . . .	3" +
Elevation, 1385.	

At the head of Left fork of Bates fork, at Joe Caudill's opening, the Hindman coal is opened 496 feet above the Fire-clay coal. The coal is within 75 feet of the gap in the ridge and has a very small workable area in this locality.

## Hindman Coal.

Coal . . . . .	.6-8"
Shale and thin sandstones . . . . .	30"
Sandstone . . . . .	10"
Shale, studded with large well preserved ferns . . . . .	24"
Coal, clean . . . . .	42"
Dark shale, slickenseit . . . . .	30"
Coal, bottom covered . . . . .	15"

On the hillside, 245 feet below the above, what is perhaps the Hazard coal, has been opened in a bed of shales. The coal is reported to be 3 feet thick.

The Whitesburg occurs 300 feet lower and shows the following section at the mouth of a flooded entry:

## Whitesburg Coal.

Shale.	
Cannel slate . . . . .	12"
Coal . . . . .	8"
Shale . . . . .	4"
Coal under water not measured.	

Ninety feet above the Whitesburg is a prominent bench which marks the horizon of the Hamlin coal.

A section of the hillside from the Whitesburg opening to the Amburgy coal at the mouth of Left fork follows:

## Section.

Whitesburg coal.	
Massive sandstone . . . . .	25 ft. +
Covered . . . . .	50 ft.
sandstone . . . . .	45 ft.
Shale . . . . .	60 ft.
Amburgy coal.	

On the left of Bates fork,  $\frac{1}{4}$  mile above Left fork, the Fire-clay coal is opened with the following section:

## Fire-clay Coal.

Massive sandstone . . . . .	4 ft. +
Coal . . . . .	25"
Splint . . . . .	1"
Coal . . . . .	11½"
Flint fire-clay . . . . .	3"
Elevation, 1380.	

The rider to the Fire-clay coal is reported to have been opened 40 feet above the Fire-clay, with a thickness of 4 feet with a 4-inch shale parting near the center. A coarse grained sandstone 75 feet in thickness comes in just beneath the Amburgy coal.

One-fourth of a mile above the mouth of Bates fork, on the right of main Turkey creek, the Fire-clay coal is opened for local use with section as follows:

## Fire-clay Coal.

Shale.	
Coal . . . . .	12"
Thin shale, not everywhere present.	
Coal . . . . .	12"
Splint . . . . .	1½"
Coal . . . . .	10½"
Flint fire-clay . . . . .	2½"
Elevation, 1380.	

**BARK CAMP BRANCH.**—On the left of Bark Camp branch,  $\frac{1}{4}$  mile up, the Fire-clay coal is opened as follows:

**Fire-clay Coal.**

Hard sandstone.	
Coal .....	18"
Splint .....	1½"
Coal .....	7½"
Flint fire-clay .....	4"
Elevation, 1393.	

On the hillside 90 feet below the Fire-clay opening, is a thin coal which comes below the Whitesburg bed. It is only 6 inches thick under 21 inches of shaly sandstone with 15 inches of black shale above.

At the old Ira Stamper place on the left of Turkey creek opposite the permanent bench mark "1263 feet," four different coals are opened on the right of the drain. Measurements of the coals with the intervals between each are given in the following section:

**Section at Ira Stamper's.**

Sandstone.	Shale.	
	Coal .....	5½"
Coal .....	Shale .....	15"
	Coal .....	48"
	Clay floor.	
Covered interval .....		276 ft.
	Shale .....	16½"
	Black shale .....	18"
	Clay .....	24"
	Coal .....	6"
	Coal and clay .....	6"
Coal, Haddix .....	Coal .....	3"
	Clay .....	5½"
	Coal .....	11½"
	Shale .....	1"
	Coal .....	6½"
	Splint .....	½"
	Coal, under water .....	10"+
Covered interval .....		200 ft.
	Coal .....	35"
	Flint fire-clay .....	5½"
Coal, Fire-clay .....	Coal .....	1"
	Clay .....	2"
	Coal, reported .....	10"
Covered interval .....		35 ft.
	Black slate .....	10"
Coal, Whitesburg .....	Cannel slate .....	12"
	Coal .....	9"+

The elevation of the Fire-clay coal is 1375 feet above sea level. The upper coal is of the Hindman bed with an interval down to the Fire-clay coal of 491 feet, as determined by levels run by the Swift Coal and Timber Company. At an interval of 120 feet below the upper coal is the base of a massive, cliff-forming sandstone, which has much the general appearance of the sandstone above the Flag coal on Bull creek, but no quartz pebbles were found in it.

Mr. Hodge\* reports finding the Hazard coal at about 300 feet above the Fire-clay at this place, and gives the following section of the bed.

\*Bull. No. 11, Ky. Geol. Surv., page 124.

## Hazard Coal.

Shale	12"
Coal	6"
Shale	12"
Coal	47"

The Fire-clay is opened again on the right of Turkey creek about 1 mile above the mouth of Bark Camp branch with section as given below.

## Fire-clay Coal.

1. Shale.
2. Coal . . . . . 24"
3. Bone . . . . . 1"
4. Coal . . . . . 8"
5. Flint fire-clay . . . . . 5"
6. Clay . . . . . 5½"
7. Coal . . . . . 4½"
8. Clay . . . . . 4"
9. Coal . . . . . 8"
10. Clay bottom.

Elevation, 1361.

A sample of coal from the above opening was collected for analysis with the following results. Numbers 1, 3, 5, 6, 7, 8, 9 and 10 were excluded from the sample.

Laboratory No. G-3735, Fire-clay coal, Turkey Creek of Line Fork.  
Average sample.

Analysis—Per cent.	Air-dried	As Received
Moisture	1.58	2.16
Volatile combustible matter	37.50	37.28
Fixed carbon	56.38	56.05
Ash	4.54	4.51
Total	100.00	100.00
Sulphur	0.93	0.92
B. T. U. per pound	13,690.00	13,610.00
Specific gravity	1.298	
Moisture lost by air drying		0.59

A number of openings on the right of the creek, ½ mile below the forks, at about the horizon of the Haddix coal, indicate a separation of that coal into two or three benches each of which shows a number of hurtful partings. The Fire-clay coal sinks below drainage at an ele-

vation of about 1340 feet. The following is a section on the right of the main creek ¼ mile above where the Fire-clay goes below drainage:

## Section on the Right of Turkey Creek ½ Mile Below the Forks.

Sandstone	35 ft.
Sandy shale	35 ft.
Blue calcareous sandstone, thin.	
Shale	15 ft.
Covered	20 ft.
Sandstone, soft	8 ft.
Fossiliferous limestone	3 ft.
Sandstone	7 ft.
Shale	20 ft.
Covered	5 ft.
Shale	14 ft.
Coal	19"
Shale	12 ft.
Covered	10 ft.

Coal.....	Sandstone	24"
	Coal	6"
	Black shale	2"
	Drab shale	36"
	Coal	22"
	Rotten coal	6"
	Bone	½"
Sandstone	Coal	4"
		15 ft.
Shale		32 ft.

Coal.....	Shale.	
	Coal	1"
	Dark shale	18"
	Coal	1"
	Dark shale	42"
	Coal	9"
	Clay	3"
	Rash	12"
Sandstone	Hard coal	10"
	Clay bottom.	

Sandstone	25 ft.
Shale	30 ft.
Shaly sandstone	25 ft.
Covered	8 ft.
Coal, Fire-clay rider.	
Covered	30 ft.
Fire-clay coal.	

The elevation of the Fire-clay coal in this section is 1340 feet.

On the left of the creek, opposite where the above section was made, one of the benches of the Haddix coal is opened 200 feet above the Fire-clay coal and shows the following section as reported by the Swift Coal and Timber Company:

Haddix Coal.	
Shale .....	24"
Coal .....	17"
Shale .....	4"
Coal .....	28"

The Hindman coal was opened by the Swift Coal and Timber Company on the hillside above the last mentioned opening, beside the trail leading to Defeated creek, at an elevation of 1851 feet or 511 feet above the Fire-clay coal. No bed section of this opening was obtained.

Two other coals were opened by the same company just above the Hindman opening, one 150 feet and the other 253 feet, above the Hindman coal. This is the highest coal known to the writer on the north side of Pine mountain. The following is a bed section of the coal furnished by the Swift Coal and Timber Company. The coal was opened on the old Stamper land and will be designated as the "Stamper coal."

Stamper Coal.	
Coal .....	30"
Bone coal .....	6"
Slate (shale) .....	10"
Coal .....	20"

The following is a section of the hillside, on the left of the creek, where the coals from the Fire-clay to 95 feet above the Stamper beds were opened. While it is not complete it gives some idea of the sandstone members above the Hindman coal.

#### Section on Left of Turkey Creek, 1/2 Mile Below Forks.

Massive sandstone .....	30 ft.
Covered .....	35 ft.
Soft, micaceous sandstone which weathers in small slabs and blocks .....	30 ft.
Stamper coal.	
Sandstone, massive in upper part and flaggy in lower part .....	40 ft.
Covered .....	65 ft.
Coal.	
Massive sandstone .....	15 ft.
Covered .....	20 ft.
Massive sandstone .....	20 ft.
Hindman coal.	
Covered .....	185 ft.
Massive sandstone .....	30 ft.
Covered .....	95 ft.
Haddix coal.	
Covered .....	200 ft.
Fire-clay coal.	

On the right, 3000 feet up the left fork, the Hindman coal was partially exposed in an old prospect at an elevation of 1800 feet. Two feet of the coal was exposed under 3 feet of clay. The coal has the appearance of being of excellent quality.

#### TOLBY BRANCH.

The Fire-clay rider is opened on the right of Tolby branch 3/4 mile up. Mr. Straub's section at the mouth of a covered entry is as follows:

Fire-clay Rider.	
Shale.	
Coal .....	3"
Shale .....	2"
Coal .....	2 1/2"
Shale .....	30"
Coal .....	28"
Clay .....	1 1/2"
Coal .....	10 1/2"
Shale.	
Elevation, 1398.	



Two hundred feet below this the Amburgy coal outcrops in the branch, showing 15 inches of coal.

#### WHITAKER BRANCH.

The Fire-clay coal rider is opened on the left of Whitaker branch of Line fork, at an elevation of 1415 feet.

##### Section at the Mouth of Branch.

Shaly sandstone.	
Coal .....	7"
Thin bedded sandstone .....	15 ft.
Shale grading to sandstone above ..	7 ft
Coal to water's edge .....	35"+
Covered .....	8 ft.
Shale .....	3 ft.
Sandstone .....	3 ft.
Shale .....	2 ft.
Fire-clay coal, reported .. ..	3 ft.

Two hundred yards to the west and 46 feet below the level of the Fire-clay coal, an old opening on the Whitesburg coal shows the following bed section:

##### Whitesburg Coal.

Sandstone.	
Cannel slate .....	24"
Coal .....	6"
Clay parting with coal below.....	
Section continued below.	
Massive sandstone .. ..	40 ft
Covered, shale in part .. ..	20 ft.
Massive sandstone .. ..	60 ft.
Shale .. ..	40 ft.
Coal.....	6"
Shale .. ..	3"
Clay .. ..	4"
Coal .. ..	4"

The Fire-clay coal outcrops at the gap between Whitaker branch and a right branch of Tolson branch of North fork, at an elevation of 1435. An opening on this bed  $\frac{1}{2}$  mile to the southwest, on the south side of Whitaker branch, shows  $31\frac{1}{2}$  inches of coal and 1 inch of bone on the bottom above the flint fire-clay.

#### BIG BRANCH.

The Fire-clay coal is opened  $\frac{1}{8}$  mile up, on the left of the left fork of Big branch, on Joe Roark's land, with following section:

##### Fire-clay Coal.

Sandstone roof.	
Coal .....	23 $\frac{1}{2}$ "
Splint .....	3 $\frac{1}{2}$ "
Coal .....	6"
Flint fire-clay .. ..	4"
Elevation, 1505.	

The same coal is opened and worked for local use on the right,  $\frac{1}{2}$  mile up the first left branch of Right fork, with section given below:

##### Fire-clay Coal.

Sandstone roof.	
Coal .....	15"
Splint .. ..	2"
Coal .....	6 $\frac{1}{2}$ "
Splint .. ..	1 $\frac{1}{2}$ "
Coal .. ..	10"
Flint fire-clay.	
Elevation, 1555.	

On the right of the right fork the same coal is opened on Mr. Jeff Ison's place at an elevation of 1575 feet. The coal, as measured by Mr. Straub, gave  $36\frac{1}{2}$  inches of coal and 1 inch of bone at the bottom above the flint fire-clay.

Sixty feet above the Fire-clay coal is an old opening on the Hamlin coal. On the same hillside and 380 feet above the Fire-clay coal, the Flag coal has been opened but the opening was closed at the time of the writer's visit. Mr. Ison, who opened the two upper coals, said each was 4 feet thick.

On the left of Line fork, 1 mile above the mouth of Big branch, on D. D. Ison's land, the Fire-clay coal is opened as follows:

## Fire-clay Coal.

Coal .. . . .	30"
Flint fire-clay . . . .	6"
Shale . . . . .	12"
Coal . . . . .	4½"
Shale.	
Elevation, 1435.	

A thin coal is exposed by the uprooting of a tree on the hill 130 feet higher.

The Haddix coal has been opened ¾ of a mile due south, on the left of the main creek, at an elevation of 1655 feet above sea level. Mr. Ison, who helped open the coal, reported it as 48 inches thick with 4 inches of clay parting near the center.

A section was made of the hill on the right of Line fork, ½ mile below the mouth of Defeated creek, where the Whitesburg, Fire-clay, Fire-clay rider and Haddix coals were opened by the Swift Coal and Timber Company. The openings on the coals were all found but were completely filled and no measurements of the coal beds could be made. The place is known as the Mose Ison property.

## Section at Mose Ison's.

Massive, cliff forming sandstone.. . . .	30 ft.
Covered . . . . .	30 ft.
Massive sandstone .....	25 ft.
Place of Flag coal.	
Covered . . . . .	25 ft.
Stratified flaggy sandstone . . . . .	30 ft.
Siliceous shale . . . . .	60 ft.
Fossiliferous limestone .....	3 ft.
Siliceous shale . . . . .	32 ft.
Sandstone . . . . .	20 ft.
Shale . . . . .	10 ft.
Opening on Haddix coal.	
Covered, sandstone in part .....	150 ft.
Hamlin coal.	
Shale and covered .....	45 ft.
Fire-clay rider.	
Sandstone . . . . .	30 ft.
Fire-clay coal—1450 A. T.	
Sandstone . . . . .	20 ft.
Shale . . . . .	25 ft.
Opening on Whitesburg coal.	
Sandstone . . . . .	25 ft.
Covered . . . . .	40 ft.
Massive sandstone ....	40 ft.
Thin bedded, slaty sandstone . . . . .	50 ft.
Covered .....	25 ft.
Cliff-forming sandstone . . . . .	40 ft.
Sandstone, thin bedded . . . . .	30 ft.
Slaty, siliceous shale to bed of Line Fork .....	75 ft.

At the old opening on the Fire-clay coal, fragments of the chocolate colored flint fire-clay were found on the dump, so that its identity is beyond question.

From a study of the above section it is evident that the thick coal found at or near this place by Mr. Hodge as given on page, 125, Bulletin 11, Ky. Geological Survey, is that of the Haddix bed. He described the thick coal as the Hazard bed, which he said was 580 feet above Line fork, or about the same as that given in the above section. The presence of the Fire-clay coal 225 feet lower and the fossiliferous limestone 62 feet above the thick coal he described as the Hazard, indicates clearly that it is the Haddix coal. His section of the thick coal is as follows:

## Haddix Coal.

Coal .. .	8"
Shale .. .	7"
Coal .. .	15"
Shale .. .	11"
Coal .. .	70"+

The interval from the Fire-clay coal to the bed of Line fork, as shown above, is 370 feet, which would indicate that the Elkhorn coal is only a short distance below the bed of Line fork at this locality.

What appears to be the Elkhorn coal, or the rider which occurs 30 feet higher, outcrops in the road a short distance below the mouth of Defeated creek and 30 feet above Line fork. It occurs in a bed of shale 8 feet thick, with a massive sandstone above and a similar sandstone below to the creek. The measures are dipping down stream.

## DEFEATED CREEK.

On the right of Big Looney branch,  $\frac{3}{4}$  mile up, the Swift Coal and Timber Company opened the Fire-clay coal. Their section of this coal is as follows:

## Fire-clay Coal.

Coal .. .	40"
Flint fire-clay .. .	5"
Coal .. .	1"
Slate .. .	3"
Coal .. .	2 $\frac{1}{4}$ "
Slate .. .	2"
Coal .. .	2 $\frac{1}{2}$ "
Slate .. .	7"
Coal .. .	7 $\frac{1}{2}$ "
Elevation, 1448.	

On the left of Defeated creek, about half way from the mouth to Deadening branch, the Fire-clay coal is at an elevation of 1520 feet. On Oldhouse branch it is opened on the right, 1000 feet up, at an elevation of 1465 feet. Just north of Mr. Zack Frazier's house, at the mouth of Oldhouse branch, Mr. Straub's section of the Fire-clay coal is as follows:

## Fire-clay Coal.

Sandstone.	
Shale .. .	6 $\frac{1}{2}$ "
Coal .. .	27"
Splint .. .	3 $\frac{1}{2}$ "
Coal .. .	5 $\frac{1}{2}$ "
Flint fire-clay.	
Elevation, 1520.	

The Fire-clay coal sinks below drainage a few feet above the mouth of Wilson or Right fork, at an elevation of 1425 feet.

On the left of the Right fork,  $\frac{1}{2}$  mile up, the Haddix coal was opened by the Swift Coal and Timber Company at an elevation of 1600 feet, but the opening was entirely closed when visited by the writer.

On the left of the left fork of Right fork, a coal was opened by the same company at an elevation of 1850 feet or 250 feet above the Haddix opening. The dip here is to the northwest so that the interval above given would be increased, making it about 475 to 480 feet above the Fire-clay coal. The interval is 20 to 30 feet smaller than is usually found between the Fire-clay and Hindman coals, but the bed section of the upper coal as shown below is clearly that of the Hindman coal on Bates fork of Turkey creek.

## Hindman Coal.

Shale.	
Hard clean coal .. .	56"
Dark shale with bands of coal .. .	25"
Hard coal 6 inches, reported .. .	18"

A thin coal 6 inches in thickness is reported 2 feet above the 56-inch bench given in the above section.

On the left of Wolfpen branch, near the mouth, the Haddix coal was opened by the Swift Coal and Timber Company. A section of the coal as given by the company is as follows:

## Haddix Coal.

Coal	5"
Slate	1"
Coal	6½"
Slate	3"
Coal	18"
Slate	10"
Coal	23"
Elevation, 1585.	

The Hindman coal was opened by the same company on the right of Grassy Spring branch, ¼ mile up, at an elevation of 1815 feet, or 230 feet higher than the Haddix on Wolfpen branch. The northwest dip, however, will increase the interval to about 280 to 300 feet. Long, rectangular slabs of coal were found at the opening but no measurements of the coal were possible.

Forty-five feet below, another coal outcrops under a hard sandstone 15 feet thick, with following section:

## First Coal Below the Hindman.

Sandstone	15 ft.
Coal	12"
Clay	½"
Coal	1½"
Clay	1"
Sandstone.	

## INGRAM CREEK.

One-fourth of a mile up Flintfield branch of Ingram creek, the horizon of the "Cartwheel" concretions twenty feet below the top of the Bee Tree shales occurs, at an elevation of 1320 feet. The full thickness of the shales on this branch is 65 feet.

On the right of the left fork of Flintfield branch, 1 mile from Ingram creek, the Fire-clay coal has the following section:

## LETCHER COUNTY

## Fire-clay Coal.

Sandstone.	
Hard coal	27"
Splint	1½"
Hard coal	10½"
Black-jack, flint clay	2"
Chocolate, flint fire-clay	4"
Shale	3"
Elevation, 1600.	

## Section continued down the branch.

Sandstone	20 ft.
Covered	130 ft.
Shale	25 ft.
Covered	40 ft.
Massive sandstone	45 ft.
Coal	10"
Slaty sandstone	30 ft.
Bee Tree shales	65 ft.
Coal.	

On the right fork of Flintfield branch, ½ mile up, the Fire-clay rider is opened as follows:

## Fireclay Rider.

Shale.	
Soft coal	2"
Clean hard coal	38"
Splint	4"
Coal	4"
Elevation, 1690.	

The Whitesburg coal has been opened 100 feet below and is reported to be 3 feet thick.

Mr. Straub's measurement of the Fire-clay coal on the left of the right fork, ¼ mile up, shows 35 inches of clean coal above the flint fire-clay.

On the right of Ingram creek, ½ mile above the mouth of Flintfield branch at Lorenzo Boggs', the following section gives the relation of the coals which have been opened by Mr. Boggs:

## Section at Lorenzo Boggs'.

Coal bloom of Haddix bed, 1862 A. T.	
Interval .....	47 ft.
Sandstone . . . . .	8 ft.
Shale .....	5 ft.
Coal, 1802, A. T.	{ Coal . . . 12"
	{ Splint . . . 3"
	{ Clay ..... 14"
	{ Shale ..... 4"
	{ Coal, reported...12"
Interval .....	65 ft.
Coal, Fire-clay rider, 1737 A. T.....	30"
Interval .....	75 ft.
Fire-clay coal, 1662 A. T.	
Interval .....	50 ft.
Whitesburg coal, 1612 A. T.	
Interval .....	80 ft.
Coal, 1532 A. T.	
Interval .....	75 ft.
Coal, Amburgy, 1457 A. T.....	31"

The top of the Bee Tree shales,  $\frac{1}{4}$  mile below Flint, is at an elevation of 1375 feet. Twenty feet from the top are numerous "cartwheel" concretions.

The Hamlin coal is opened on the right of the left branch which enters the main stream at Flint, where the following measurements were made:

## Hamlin Coal.

Sandstone.	
Shale . . . . .	24"
Coal . . . . .	30"
Black shale . . . .	$\frac{1}{4}$ "
Gray clay . . . . .	3"
Micaceous sandstone.	
Elevation, 1707.	

One hundred and five feet below is a prominent bench which marks the place of the Whitesburg coal.

An unusual deposit of cannel coal has been opened on the left of Line fork,  $\frac{3}{4}$  mile above Ingram creek, on the Joe Cornett property. The elevation of the mouth of the entry is 1180 feet. The coal crowns a massive sandstone which at the mouth of Cornett's branch,  $\frac{1}{2}$  mile up the creek, is over 30 feet thick. The Fire-clay coal occurs

on the opposite side of Line fork at an elevation of 1607 feet, or 427 feet above the cannel coal. The interval between the two coals is about that between the Fire-clay and Elkhorn coals. A thin seam of cannel coal outcrops at about the same geologic horizon, from the Cornett opening to beyond Camp branch of Dry fork and up main Line fork for  $\frac{3}{4}$  mile above the mouth of Dry fork. In places the cannel coal is only 12 to 18 inches thick; then in a few hundred feet it thickens to 5 feet or more and again diminishes to its former thickness, forming small, local pockets. The Cornett opening was made where the lense is perhaps at its maximum thickness. The cannel coal at the head of Kings creek is at the same geologic horizon.

On Dry fork the cannel seam is everywhere marked by a thin ledge of blue, fine grain sandstone or "silt rock," 6 to 8 inches thick, which occurs 8 to 15 feet above the cannel seam. The two following sections are of the cannel coal, No. 1 at Joe Cornett's bank and No. 2 200 yards up Camp branch of Dry fork. The two openings are one mile apart.

## Sections of Cannel Coal.

No. 1.	No. 2.
1. Cannel slate .....	Cannel slate .....
2. Cannel coal .....	Cannel coal .....
3. Cannel coal .....	Splint .....
4. Cannel slate . . . .	Bituminous coal to water
5. Cannel coal . . . .	6", reported .....
6. Cannel slate . . . .	

Less than 100 yards from the Camp branch opening the coal has thinned to the following:

## Section No. 3.

Cannel slate . . . .	5"
Cannel coal . . . .	11 $\frac{1}{2}$ "
Semi splint . . . .	12 $\frac{1}{2}$ "
Hard shale floor.	

A sample of the cannel coal was collected from the Cornett bank for analysis. The sample only included 28 $\frac{1}{4}$  inches, beginning 5 $\frac{3}{4}$  inches from the top.

## Analysis of the Joe Cornett Cannel Coal.

Laboratory No. G-3731, Cannel Coal, Cornett bank, Line Fork.  
Average sample.

Analysis—Per cent.	Air-dried	As Received
Moisture .....	0.88	1.14
Volatile combustible matter .....	37.86	37.76
Fixed carbon .....	57.48	57.33
Ash .....	3.78	3.77
Total .....	100.00	100.00
Sulphur .....	0.59	0.59
B. T. U. per pound .....	12,825.00	12,790.00
Specific gravity .....	1.364	
Moisture lost by air drying .....		0.26

## CORNETTS BRANCH.

On the right of Cornetts branch,  $\frac{1}{4}$  mile up, what is apparently the rider to the Elkhorn occurs at an elevation of 1200 feet, with another coal bloom 45 feet higher.

## Elkhorn Rider.

Shale .....	28"
Coal .....	4"
Shale .....	1 $\frac{3}{4}$ "
Coal .....	2 $\frac{1}{2}$ "
Shale .....	14"
Coal .....	1 $\frac{3}{4}$ "
Shale .....	5"
Coal .....	2"
Shale .....	5 $\frac{1}{2}$ "
Coal .....	13"

The Haddix coal is opened on the right,  $\frac{1}{2}$  mile up Cornetts branch, with the following section.

## Haddix Coal.

Shale grading upward into sandstone.

1. Coal .....	30"
2. Bony splint .....	4"
3. Coal .....	56"
4. Clay .....	1 $\frac{1}{2}$ "
5. Coal .....	4 $\frac{1}{2}$ "
6. Clay .....	2 $\frac{1}{2}$ "
7. Coal .....	11"

Elevation, 1751.

A sample of coal collected from the above excluding 2, 4, 5, 6 and 7 gave the following analysis:

## Analysis of Haddix Coal.

Laboratory No. G-3732, Haddix Coal, Cornett Branch of Line Fork.  
Average sample.

Analysis—per cent.	Air-dried	As Received
Moisture .....	1.59	2.14
Volatile combustible matter .....	37.77	37.56
Fixed carbon .....	54.15	53.85
Ash .....	6.49	6.45
Total .....	100.00	100.00
Sulphur .....	1.07	1.06
B. T. U. per pound .....	13,060.00	12,990.00
Specific gravity .....	1.317	
Moisture lost by air drying .....		0.56

At the face of the entry, 50 feet in, two irregular lenses of clay appear in the upper part of the seam but disappear in a few feet. The entire bed is slickensided, showing considerable movement which destroyed in part the natural structure of the coal, producing laminae that in places are vertical or inclined at any angle, giving the coal the appearance of a gnarled, knotty piece of wood. The peculiar structure is doubtless local and will disappear further under cover.

The shale above the coal is stratified and normal and shows no sign of the movement which has affected the coal.

From the mouth of Dry fork to  $\frac{1}{4}$  mile above the mouth of Long branch of Line fork, the Fire-clay coal forms the principal source of domestic coal used in this region. At no place does it attain a thickness equal to the general thickness of this coal on the waters of Rock-house, and most of the streams northeast of North fork in Letcher county. However, its excellent quality, accessibility, and the fact that the banks remain open from year to year without any great amount of labor spent on them, render this coal more desirable for local use than the thicker coals higher in the hills.

On Holcomb branch the Fire-clay coal is at an elevation of 1607 feet or about 400 feet above Line fork. It sinks below drainage  $\frac{1}{4}$  mile above the mouth of Long

branch at an elevation of about 1385, giving a dip up stream about parallel to Pine mountain.

The Fire-clay coal occurs only on the northwest side of Line fork. The Pine mountain fault occurs generally far down on the northwest slope of the mountain and limits the coal-bearing rocks to that part of the mountain below the fault. The few openings that have been made on coals on the southeast side of Line fork found them so disturbed and broken that they are worthless even for domestic use.

The Whitesburg and Hamlin coals are both too thin to be of any value on any of the branches of Line fork above the mouth of Dry fork.

The following sections of the Fire-clay coal on Line fork above Dry fork give a general idea of its thickness.

#### Fire-clay Coal.

##### On Holcomb Branch.

Shale roof.	
Coal .....	16½"
Splint .....	1"
Coal .....	8"
Splint .....	5"
Flint fire-clay.	
Elevation of coal, 1607.	

##### On Big Branch.

Shale.	
Coal .....	24"
Splint .....	6½"
Black jack .....	¾"
Chocolate colored, flint fire-clay .....	4"
Coal .....	1"
Sandstone bottom.	
Elevation of coal, 1565.	

##### On Second Branch Above Big Branch.

Sandstone.	
Shale .....	1½"
Coal .....	25"
Splint .....	4"
Flint fire-clay.	
Elevation of coal, 1553.	

##### ½ Mile West of Gordon.

Shale .	6"
Coal .....	32"
Flint fire-clay.	
Elevation, 1480.	

#### Trace Fork, ½ Mile Below Forks

Slaty sandstone.	
Coal .....	34"
"Black jack" .....	1"
Flint fire-clay .....	4"
Coal .	2"
Clay floor.	
Elevation of coal, 1440.	

#### Long Branch, 300 Yards Up.

Shale.	
Soft coal ...	4"
Shale . . . . .	1½"
Coal . . . . .	16"
Splint . . . . .	2"
Coal . . . . .	6"
Bone . . . . .	2"
Flint fire-clay.	
Elevation of coal, 1390.	

The following is an analysis of the coal from Holcomb branch:

#### Analysis of Fire-clay Coal.

Laboratory No. G-3733, Fire-clay coal, Holcomb branch of Line fork. Average sample.

Analysis—Per cent.	Air-dried	As Received
Moisture . . . . .	1.59	2.06
Volatile combustible matter . . . . .	39.46	39.27
Fixed carbon . . . . .	54.88	54.62
Ash . . . . .	4.07	4.05
Total . . . . .	100.00	100.00
Sulphur .. . . .	0.87	0.87
B. T. U. per pound . . . . .	13,570.00	13,500.00
Specific gravity .. . . .	1.282	
Moisture lost by air drying . . . . .		0.48

The Haddix coal occurs about 200 feet above the Fire-clay coal. A large number of openings were made on this coal by the Swift Coal and Timber Company, from Cornetts branch to the head of Line fork. The openings were made one year before the present investigations were made by the writer, and the greater number of them were either completely filled or only a portion of the coal showing.

#### PICTURE BRANCH.

On the left of Picture branch, ¾ mile up, the Haddix coal occurs 40 feet below a fossiliferous limestone and 210 feet above an old opening on the Fire-clay coal. The Haddix coal is reported to be 42 inches thick with a thin

clay parting near the center. The thick coal on Cornetts branch has here either thinned or split into two or three benches.

Near the head of Picture branch, on the left, a coal was opened by the Swift Coal and Timber Company at an elevation of 1925 feet and 275 feet above the Haddix coal. The interval between the two coals indicated that the upper one is the Hindman bed. The coal is reported to be 61 inches thick without parting.

One hundred and forty feet above the Haddix opening is the base of a massive coarse grained sandstone 30 feet thick which forms a steep scarp on the hillside.

#### TRACE BRANCH.

On the right of Shipley fork of Trace branch,  $\frac{1}{8}$  mile up, a coal which is 32 feet below the main Haddix bed, shows the following section in a partially filled prospect:

##### First Coal Below the Haddix.

Shale.	
Coal .....	1½"
Dark shale .....	1"
Coal .....	2½"
Shale .....	6"
Coal .....	14"
Dark shale .....	20½"
Bone .....	4"
Coal, reported .....	24"

The Flag coal has been opened on the right of a right drain 1 mile up Shipley fork, at an elevation of 1822 feet. Allowing for a northwest dip of 36 feet from the mouth of Shipley fork to the Flag opening (the amount given by the Swift Coal and Timber Company) the vertical interval from the Haddix to the Flag is 200 feet. The following section was obtained at the face of a partially filled opening, the remainder supplied by the Swift Coal and Timber Company.

#### Flag Coal.

1. Coal rider .....	12"
2. Blue shale containing iron nodules.....	48"
3. Coal .....	13"
4. Bone coal .....	1½"
5. Coal, to bottom of partially filled opening.....	21½"
6. Coal, reported .....	23"
7. Shale or clay parting, reported .....	12"
8. Coal, reported .....	12"

A sample of coal from the above place was analyzed with the following results. Numbers 1, 2, 6, 7 and 8 were excluded from the sample.

#### Analysis of Flag Coal.

Laboratory No. G-3734, Flag Coal, Shipley Fork of Trace Fork of Line Fork. Average sample.

Analysis—Per cent.	Air-dried	As Received
Moisture .....	1.55	2.27
Volatile combustible matter .....	38.11	37.82
Fixed carbon .....	55.78	55.38
Ash .....	4.56	4.53
Total .....	100.00	100.00
Sulphur .....	0.67	0.67
B. T. U. per pound .....	13,630.00	13,530.00
Specific gravity .....	1.297	
Moisture lost by air drying .....		0.73

Forty to fifty feet below the Flag coal in this region, with a massive sandstone between, is a coal which is opened on the right of Trace branch. The Flag coal is marked by a very pronounced bench which was followed from the opening on Shipley to the east side of Trace,  $\frac{1}{4}$  mile below the mouth of Shipley fork, where the lower coal is opened. The lower coal here is that of the Hazard bed.

#### Hazard Coal.

Place of Flag coal.	
Massive, cliff-forming sandstone .....	50 ft.
Coal .....	24"
Clay floor.	



## LONG BRANCH.

On the right, 300 yards up, the Fire-clay coal is opened at an elevation of 1390 feet.

The Haddix coal is opened on the right,  $\frac{3}{4}$  mile up, with the following section, furnished by the Swift Coal and Timber Company.

Haddix Coal.	
Coal .....	41"
Slate .....	11"
Coal .....	14"
Slate .....	3"
Coal .....	5"
Slate .....	2"
Coal .....	23"
Elevation, 1592.	

One hundred and forty-five feet higher is the base of a massive sandstone which marks the place of the Hazard coal.

## COYLE BRANCH.

The Haddix coal was opened on the right,  $\frac{1}{2}$  mile up, showing a southwest dip from the last opening on Long branch of 45 feet. A section of the bed, furnished by the Swift Coal and Timber Company follows:

Haddix Coal.	
Coal .....	48"
Slate .....	10"
Coal .....	17"
Slate .....	11½"
Coal .....	7"
Slate .....	4"
Coal .....	28"
Elevation, 1547.	

A thick coal was opened by the same company  $\frac{1}{2}$  mile further up, on the right fork of Coyle, with an interval according to spirit level of 290 feet above the Haddix opening. The interval measured by the writer with aneroid was 265 feet. A section between the two openings was made with aneroid with the following results.

The opening of the upper coal was partially filled and the measurements for it were furnished by the Swift Coal and Timber Company.

## Section on Right Fork of Coyle Branch.

Siliceous shale .....	10 ft.
Coal, reported .....	61"
Sandstone .....	25 ft.
Coal, covered.	
Covered .....	10 ft.
Coal.	
Siliceous slate .....	40 ft.
Sandstone .....	50 ft.
Sandstone, massive .....	30 ft.
Shale .....	55 ft.
Sandstone at top, covered below .....	55 ft.
Coal, Haddix, 1547 A. T. ....	60"
Shale ..	30 ft.
Shaly sandstone or sandy shale .....	60 ft.
Coal .....	1 ft.

The upper coal is too high above the Haddix for the Flag coal and the interval is about 40 feet smaller than is usually found between the Haddix and Hindman.

## JAKES BRANCH.

On the side of the trail leading over to Stony fork of Leatherwood, a coal was opened 40 feet above the top of a massive sandstone in a bed of shale. The coal, as reported by the above mentioned company, shows the following section. The interval down to the Haddix coal is 291 feet. At the top of the massive sandstone below the upper coal is a thin coal reported 30 inches thick.

## Hindman Coal.

Coal ..	59"
Slate .....	3"
Coal ..	4½"

Two miles up Jakes branch the following section was made below the Hindman coal:

## Section on Jakes Branch.

Shale ..	5 ft.
Black bituminous shale ..	2"
Coal	14½"
Semi splint } Hindman, 1775 A. T. ..	24½"
Covered, with massive sandstone in lower part	30 ft.
Coal ..	16"
Shale ..	24"
Massive sandstone.	

The Haddix coal sinks below drainage at the mouth of Road fork of Jakes branch. On main Line fork it goes below drainage between the mouth of Jakes branch and Bear branch.

The Haddix coal was opened at two places on the south side of Line fork, one opposite the mouth of Coyle branch and the other opposite the mouth of Jakes branch. The following section, at the latter place, was furnished by the Swift Coal and Timber Company:

## Haddix Coal.

Coal .....	42"
Shale .....	3½"
Coal .....	13"
Shale .....	4"
Coal .....	9"
Shale .....	5"
Coal .....	20"

## BEAR BRANCH.

On the right, ¾ mile up, a coal is opened at an elevation of 1775 feet. The following is a section at the mouth of a flooded entry:

## Hindman Coal.

Shale ..	7 ft.
Coal ..	12"
Hard, blue sandstone to water .....	4-12"
Coal....	24"
Shale.. } Reported .....	¼"
Coal.... } .....	1"
Elevation, 1775.	

Two higher coals are reported by Alfred Hall, who lives on Bear branch, one 155 feet and the other 435 feet respectively above the Hindman opening. The lower of these coals is reported to be about 4 feet thick.

## ELK CREEK OF NORTH FORK OF KENTUCKY RIVER.

The following is a general section of Elk creek, modified for dip, giving the openings on the various coals with the exposed strata and intervals between the coals.

## Section on Elk Creek.

Sandstone .....	15 ft.
Flag coal	Shale roof. Coal .. 5" Sulphur .. ½" Coal .. 11¼" Semi-splint .. 15" Splint .. 3" Hard coal .. 6" Slate bottom.
Covered, with massive sandstone at the base .....	65 ft.
Hazard coal.....	Sandstone. Coal, rider .. 15" Clay with 2" coal in the center .. 20" Coal, hard .. 5¼" Splint and semi-splint .. 26" Coal, hard .. 10½" Splint .. 1" Coal, hard .. 4½" Clay floor.
Interval .....	65 ft.
Coal.	
Shale, in part .....	65 ft.
Shale .....	60 ft.
Sandstone .....	55 ft.
Coal .....	21½"
Siliceous shale .....	25 ft.

Coal.....	{ Coal .....	9"	
	{ Clay .....	8"	
	{ Shale .....	8"	
	{ Clay .....	6"	
	{ Coal .....	4"	
Shale .....			28 ft.
Coal .....			6"
Sandstone .....			55 ft.
Fire-clay coal....	{ Sandstone.		
	{ Coal .....	41"	
	{ Flint fire-clay .....	4"	
	{ Coal .....	7"+	
Sandstone .....			40 ft.
Whitesburg coal.	{ Black slate ..	12"	
	{ Cannel slate .....	1½"	
	{ Coal .....	9"	
	{ Black shale ..	3"	
	{ Coal .....	1"	
Shale .....	{ Clay bottom.		
			22 ft.
Coal.			
Shale and sandstone .....			13 ft.
Sandstone .....			80 ft.
Shale and micaceous sandstone .....			75 ft.
Amburgy (?) coal.	{ Shale .. . . .	2½"	
	{ Black slate ..	4½"	
	{ Clean coal ..	21½"	

The Amburgy coal or perhaps the first coal below it, is opened on the left of the main creek 1 mile up, where the section in the general section was measured, at an elevation of 1060 feet.

The Fire-clay coal is opened in three places; first on the left of the first left branch on Ed Dixon's land at an elevation of 1320 feet, where the coal above the flint clay parting is 41 inches thick. The flint clay is here 4¾ inches with coal below.

The second opening is on the left of the main creek, 1¼ miles up at an elevation of 1300 feet. At the mouth of the entry the coal is 40 inches thick above 5 inches of flint fire-clay with coal below.

The third opening is on the left 2 miles up, opposite the mouth of Lick branch, at Rachel Dixon's. The section

of this coal is that given in the general section of the creek, with elevation of 1330.

The Fire-clay coal lies low in the hills and has a general thickness of about 40 inches of clean, hard coal above the flint clay parting which gives an excellent floor for mining conditions.

The Whitesburg, as shown in the general section, is thin and worthless as a source of fuel.

The next coal of importance above the Fire-clay bed is the Hazard coal which has been opened on the right of the last large right branch, 2½ miles from the mouth of the main creek. It is opened near the gap between Elk creek and a left branch of Caudill branch and has a small area here, but towards the head of the creek and to the southwest, the area increases and it becomes one of the valuable coals in this region. A section of the coal is given in the general section of the creek. A sample of this coal was collected for analysis.

#### Analysis of Hazard Coal.

Laboratory No. G-3699, Hazard coal, Elk creek. Average sample.			
Analysis—Per cent		Air-dried	As received
Moisture .....		1.30	2.70
Volatile combustible matter ..		34.50	34.01
Fixed carbon . . . . .		58.00	57.18
Gray ash .. . . .		6.20	6.11
Total .. . . .		100.00	100.00
Sulphur .. . . .		.70	.69
B. T. U. per pound .. . . .		13,880.00	13,680.00
Specific gravity .. . . .		1.326	
Moisture lost by air drying.....			1.41

The thin 15-inch rider was not sampled. The ash is high, due to the nearness to the outcrop.

With an interval of 65 feet above the Hazard bed, the Flag coal is opened on the right of the main creek near the head, at Willie Dixon's. The section of the coal is given in the general section. A sample of the coal when analyzed gave the following results.

## Analysis of Flag Coal.

Laboratory No. G-3698, Flag coal, Elk creek. Average sample.			
Analysis—Per cent		Air-dried	As received
Moisture .....		1.39	2.62
Volatile combustible matter .....		38.09	37.61
Fixed carbon .....		55.08	54.40
Gray-buff ash .....		5.44	5.37
Total .....		100.00	100.00
Sulphur .....		.75	.74
B. T. U. per pound .....		14,000.00	13,830.00
Specific gravity .....		1.289	
Moisture lost by air drying .....			1.25

On the right of North Fork opposite Blackey the Fire-clay coal is opened as shown below:

## Fire-clay Coal.

Sandy shale .....	60"
Draw slate .....	4"
Bone .....	1"
Coal, clean .....	35"
Fire-clay .....	3"
Coal .....	1"
Hard, blue shale.....	3"
Coal .....	9½"
Shale floor.	
Elevation, 1360.	

The same coal, opened on the left of the river between Blackey and the mouth of Rockhouse creek, shows the following:

## Fire-clay Coal.

Shale.	
Coal .....	5"
Clay .....	2"
Coal .....	43"
Flint fire-clay .....	3"
Coal, rash .....	1"
Clay .....	2"
Coal .....	4"
Clay bottom.	
Elevation, 1355.	

The above opening is about 370 feet above the mouth of Rockhouse creek.

## ROCKHOUSE CREEK.

A thin coal outcrops at water level  $\frac{1}{4}$  mile up Rockhouse, and rises above stream level up the creek. The interval up to the Fire-clay coal and the general appearance of the coal indicate the Elkhorn rider. It has a siliceous shale floor with a similar rock above for 8 feet to a massive sandstone 75 feet thick or more.

On Crases branch,  $\frac{3}{4}$  mile up Rockhouse, the Fire-clay is opened with the following section:

## Fire-clay Coal.

Shale roof.	
Coal .....	2"
Clay shale .....	2"
Coal .....	38"
Flint fire-clay .....	5"
Elevation, 1340.	

## CAUDILL BRANCH.

On the left of the first left branch,  $\frac{1}{2}$  mile up, the Fire-clay coal occurs at an elevation of 1350 feet A. T.

Three hundred and fifty feet higher the Hazard coal appears, partially opened.

## Hazard Coal.

Sandstone.	
Coal .....	12"
Shale .....	5½"
Coal .....	2-3"
Gray shale .....	3-5½"
Coal .....	3"
Black shale .....	1-1½"
Hard coal, bottom	
covered .....	24"
Elevation, 1700.	

Overlying the coal is a coarse grained sandstone which appears yellow on weathering and forms a cliff above the coal.

The Fire-clay coal is opened 1 mile further up, on the left, at Mrs. Nancy Caudill's where the following measurements were made at a new prospect opening:

## Fire-clay Coal.

Siliceous shale.	
Clean coal .....	44½"
Flint fire-clay .....	3½"
Black slate .....	¼"
Coal .....	18½"
Cannel slate or coal.	1"
Clay floor.	
Elevation, 1340.	

At Ison Caudill's, on the right, at the head of the branch, a measurement on the Fire-clay coal in a local bank 100 feet in, shows the following:

## Fire-clay Coal.

Shale.	
Draw slate .....	2-3"
Light rashy coal.....	½"
Clean coal .....	40½"
Flint fire-clay .....	4½"
Coal .....	15"

## SPRING BRANCH.

Another good showing of the same coal occurs on the right, ½ mile up.

## Fire-clay Coal.

Coal .....	28"
Splint .....	4"
Coal .....	4"
Flint fire-clay .....	4"
Coal .....	2"
Splint .....	6"
Coal .....	7"
Shale floor.	
Elevation, 1400.	

## Section at Grant Ison's at Jeremiah.

Coal, Fire-clay, 1375 A. T.	
Covered, sandstone in part .....	30 ft.
Siliceous shale .....	20 ft.
Coal, Whitesburg, 1325 A. T.	
Covered .....	115 ft.
Shale .....	50 ft.
Cliff-forming sandstone .....	20 ft.
Gray shale .....	5 ft.
Coal, 1135 A. T.	
Shale .....	25 ft.
Coal, 1110 A. T.	
Slaty shale .....	4 ft.
Sandstone on top, sandstone and shale below.....	52 ft.

On the left of Rockhouse, ⅛ mile below the mouth of Doty branch, the Fire-clay coal shows 40 inches of clean coal above the flint clay parting. Elevation 1375 feet A. T.

Two hundred and sixty-five feet lower is a 22-inch coal with a clay parting 6½ inches from the top, with shale above and a thin bedded sandstone below.

## DOTY BRANCH.

A general section of the strata exposed on Doty branch, from the head of the right fork to the mouth of the main stream, was made as shown below:

## Section on Doty Branch.

Massive, pebble-bearing sandstone .....	30 ft.
Splint coal, bottom covered .....	40"
Covered interval .....	265 ft.
Sandstone .....	20 ft.
Covered .....	35 ft.
Sandstone .....	35 ft.
Shale and sandstone .....	30 ft.
Fire-clay coal.....	
{ Shale.	
Coal .....	
Sulphur band .....	
Coal .....	
Bone .....	
Coal .....	
Flint fire-clay .....	
Coal .....	
Sandstone and shale .....	95 ft.
Coal, thin.	
Shale .....	15 ft.
Sandstone .....	35 ft.
Siliceous shale .....	50 ft.
Coal .....	16"
Shale, siliceous .....	10 ft.
Sandstone .....	15 ft.
Coal .....	24"
Shale .....	40 ft.
Sandstone, highly cross-bedded .....	15 ft.

The only two coals of commercial importance opened on this branch are the Fire-clay and Flag beds. The former is opened on the left of the first branch of Doty with the section given above. Another opening, now fallen in, occurs on the left of the right fork  $\frac{1}{2}$  mile up, at an elevation of 1335 feet.

The highest coal shown in the section is the Flag which occurs 365 feet (without correction for dip) above the Fire-clay opening. It occurs at the head of the right fork  $\frac{1}{2}$  mile north of the Fire-clay opening. With the northwest dip of the measures the interval between the

two coals will be slightly in excess of that given above. The sandstone overlying the Flag coal contains numerous quartz pebbles up to  $\frac{1}{2}$  inch in diameter. It forms a steep scarp around the hill and large boulders break loose from the parent ledge and gradually work down the hill. A sample of the coal when analyzed gave the following result:

## Analysis of Flag Coal.

Laboratory No. G-3700, Flag coal, Right fork of Doty branch.  
Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.20	2.71
Volatile combustible matter .....	35.15	34.61
Fixed carbon .....	59.11	58.21
Gray-brown colored ash .....	4.54	4.47
Total .....	100.00	100.00
Sulphur .....	.55	.54
B. T. U. per pound .....	14,250.00	14,030.00
Specific gravity .....	1.288	
Moisture lost by air drying .....		1.53

## BLAIR BRANCH.

On the left, 2 miles up this branch, the Fire-clay coal shows the following section:

## Fire-clay Coal.

Shale .....	40 ft.
Coal .....	10"
Fibrous coal .....	1"
Coal .....	23"
Flint fire-clay .....	3½"
Coal .....	15"
Elevation, 1475.	

The stain of the Fire-clay rider is exposed in the road 40 feet above the Fire-clay opening.

The Haddix coal shows in the road leading to Bee Tree branch of Smoot, at an elevation of 1675 feet and 40 feet below a fossiliferous limestone which outcrops in the gap.

On the left of the branch and 45 feet below the gap to Walters branch of Rockhouse, the Flag coal is opened

390 feet above the Fire-clay bed as given above. It occurs at the base of a massive, cliff-forming sandstone similar to that on Doty branch.

#### Flag Coal.

Shale . . . . .	36"
Clean coal . . . . .	52½"
Shale bottom.	
Elevation, 1865.	

#### GARNER BRANCH.

On the left, ¼ mile up Garner branch, the Fire-clay coal is opened with following section:

#### Fire-clay Coal.

Sandstone.	
Shale . . . . .	60"
Coal . . . . .	11"
Fibrous coal, but no evidence of sulphur	1"
Coal . . . . .	18"
Flint fire-clay . . . . .	3"
Coal . . . . .	10"
Elevation, 1416.	

#### LITTLE COLLY CREEK.

On the left, opposite the mouth of Cow branch, the Whitesburg coal is opened with the following section:

#### Whitesburg Coal.

Shale.	
Sandstone . . . . .	60"
Coal . . . . .	26"
Clay . . . . .	1"
Coal . . . . .	8½"
Elevation, 1505.	

A thin coal is opened on the left, ¾ mile above Tillie, at an elevation of 1340 feet. It contains 21 inches of coal with a 2-inch slate parting 1 inch from the top. This coal is 320 feet below the Fire-clay coal at the head of the creek.

On the right, ½ mile from the gap to Camp branch, the Fire-clay coal is opened at an elevation of 1663 feet.

While high in the hill, it has a considerable area between Little Colly and Smoot creeks. It is cut out in the gap to Camp branch.

#### Fire-clay Coal.

Sandstone.	
Coal . . . . .	30"
"Black jack" . . . . .	2"
Flint fire-clay . . . . .	4"
Coal . . . . .	21"
Elevation, 1663.	

Twenty feet lower a coal stain shows in a bed of shale.

#### ELKHORN BRANCH.

Two workable coals occur on this short branch. The Fire-clay occurs on the right, ½ mile up, at an elevation of 1515 feet, and shows 48 inches of coal with 4 inches of flint clay 10 inches from the bottom. Beginning 205 feet below the Fire-clay coal, the following section shows the relation of two coals, one of which is the Amburgy bed:

#### Section at Mouth of Elkhorn Branch.

Thin bedded sandstone.	
Coal . . . . .	4"
Clay parting . . . . .	2"
Coal . . . . .	18"
Shale and covered . . . . .	35 ft.
Rotten, calcareous shale containing marine fossils . . . . .	8"
Clean coal . . . . .	40"
Shale floor.	

The lower bed is also opened just back of Henry Combs' house, ¼ mile above the mouth of Elkhorn branch, where the coal has thinned to 31½ inches.

#### Amburgy Coal.

Black, calcareous shale containing marine fossils.	
Coal . . . . .	27½"
Clay . . . . .	¾"
Coal . . . . .	3"

The following is an analysis of a sample collected from this coal excluding the clay parting:

#### Analysis of Amburgy Coal.

Laboratory No. G-3701, Amburgy coal, Elkhorn branch of Rockhouse. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	.90	1.55
Volatile combustible matter .....	41.92	41.65
Fixed carbon .....	49.95	49.62
Gray ash .....	7.23	7.18
<b>Total</b> .....	<b>100.00</b>	<b>100.00</b>
Sulphur .....	2.68	2.66
B. T. U. per pound .....	13,960.00	13,870.00
Specific gravity .....	1.323	
Moisture lost by air drying .....		.66

#### DANIELS BRANCH.

Two workable coals are opened on this branch. The Fire-clay bed is opened on the right of the road fork,  $1\frac{1}{2}$  miles up, at an elevation of 1462 feet. A large area of this coal occurs in this region. The thickness of the bed is shown in the general section below.

The Hindman coal is opened on the left, 1 mile up, at the W. R. Polly bank, with only 100 feet of cover to the top of the ridge between Daniels branch and the waters of Little Carr creek, and again on the right,  $1\frac{1}{4}$  miles up, just below the gap to the waters of Trace fork of Rockhouse, at Bristol Taylor's house. At the former place 4 feet of coal appears at the mouth of a flooded entry and is reported 5 feet thick. At the Taylor bank the coal is much thinner as shown in the general section below.

#### General Section on Daniels Branch.

Sandstone.	
Calcareous sandstone which is reported to contain 19 per cent of lime.....	10 ft.+
Shale .....	20 ft.
Hindman coal....	<div> <div>Coal ..</div> <div>Sulphur .</div> <div>Coal ..</div> </div> <div> <div>.26½"</div> <div>¾"</div> <div>.46¾"</div> </div>
Covered ..	100 ft.
Coal stain, thin.	
Massive, cliff-forming sandstone ..	40 ft.
Flag coal .....	31"
Covered interval ..	240 ft.
Coal, thin.	
Shale .....	5 ft.
Sandstone .....	10 ft.
Covered .....	65 ft.
Sandstone .....	50 ft.
Fire-clay coal....	<div>Coal ..</div> <div>Flint clay ..</div>

39"

4"+1445 A. T.

The calcareous sandstone 20 feet above the Hindman coal, is general throughout the county north of Pine mountain and was found in a similar position above the High Splint in Black mountain.



## Analysis of Fire-clay Coal.

Laboratory No. G-3702, Fire-clay coal, Daniel's branch, Rockhouse creek. Average sample.

Analysis—Per cent	Air-dried	As received
Moisture .....	1.45	2.35
Volatile combustible matter .....	38.36	38.01
Fixed carbon .....	56.88	56.36
Buff colored ash .....	3.31	3.28
Total .....	100.00	100.00
Sulphur .....	.77	.76
B. T. U. per pound .....	14,460.00	14,330.00
Specific gravity .....	1.272	
Moisture lost by air drying.....		.91

## Analysis of Hindman Coal.

Laboratory No. G-3703, Hindman coal, head of Daniel's branch. Average sample.

Analysis—Per cent	Air-dried	As received
Moisture .....	1.90	2.93
Volatile combustible matter .....	37.24	36.85
Fixed carbon .....	53.81	53.24
Gray ash .....	7.05	6.98
Total .....	100.00	100.00
Sulphur .....	.69	.68
B. T. U. per pound .....	13,705.00	13,550.00
Specific gravity .....	1.328	
Moisture lost by air drying .....		1.05

A short distance below the mouth of Millstone branch a coal that was formerly known as the Rockhouse coal, appears above drainage and rises up main Rockhouse more rapidly than the fall in the stream. It consists of 3 feet 10 inches to 4 feet 1 inch of solid coal and in this region generally has a black slate roof. It occurs approximately 400 feet below the Fire-clay coal, which is the interval on the headwaters of North fork between the Fire-clay and Elkhorn coals. The correlation of the Rockhouse coal with the Elkhorn coal was first shown in Volume 1, Series IV., of the new Kentucky Geological Survey. It extends up Camp branch for a distance of 3 miles before it sinks below drainage, to reappear again

on the headwaters of Crafts Colly, Thornton and Millstone creeks. It is opened in a number of places on Rockhouse creek to a short distance below the mouth of Stevens fork, where it sinks below drainage.

The Elkhorn coal is the most valuable coal on the upper Rockhouse waters, since it lies only a few feet above drainage and underlies a large area. The quality of the coal, as shown by analyses made from the coal on this stream, is equal to that in the region of Jenkins and McRoberts, with the added advantage of offering better mining conditions, due to the absence of the thick clay parting which occurs at the head of North fork and on Elkhorn creek of Big Sandy. For a mile above where it emerges above drainage on Rockhouse the coal has a clay parting 6 inches thick in places and less than 1/2 inch in others. Above Camp branch the parting is either very thin or absent entirely.

From the mouth of Millstone branch to the head of Rockhouse and tributaries, the following measurements of the bed section of the Elkhorn coal were made.

On the right of main Rockhouse 1 mile below Camp branch, at an elevation of 1175 feet, it is 43 inches thick. On the left at same place it shows:

Shale.	
Coal .....	24"
Clay parting .....	6"
Coal .....	20"

## On left of Sugar branch of Camp branch.

Coal .....	22 1/2"
Clay .....	1/2"
Coal .....	1"
Clay .....	1/2"
Coal .....	22"
Clay floor.	

## Analysis of Elkhorn Coal.

Laboratory No. G-3706, Elkhorn coal, Camp branch of Rockhouse.  
Average sample.

Analysis—Per cent	Air-dried	As received
Moisture .....	.98	1.36
Volatile combustible matter .....	39.55	39.40
Fixed carbon .....	54.69	54.48
Lilac ash .....	4.78	4.76
<b>Total</b> .....	<b>100.00</b>	<b>100.00</b>
Sulphur .....	1.70	1.69
B. T. U. per pound .....	14,710.00	14,650.00
Specific gravity .....	1.294	
Moisture lost by air drying .....		.39

The Elkhorn coal at the mouth of right fork of Camp branch has 48 inches of solid coal, under black slate roof.

One-half mile up Little Sandlick branch it is:

Shale.	
Coal .....	23"
Shale parting .....	½"
Coal .....	24½"

Four openings on the Elkhorn coal on Camp branch for a distance of 1 mile above the mouth of Little Sandlick branch, where it sinks below drainage, show a solid bed of coal from 42 to 49 inches in thickness.

On Camp branch a thin rider of coal from 8 to 18 inches thick, occurs 30 feet above the main Elkhorn bed.

The Elkhorn coal goes under drainage on Indian creek 1¼ miles up. On the left, 1 mile up, the coal is 42 to 48 inches of clean coal underlying a black shale 8 to 20 feet in thickness, with 20 feet of massive sandstone above. The sandstone is very irregular in thickness and in places comes down to within 8 feet of the coal.

At the mouth of Beaver Dam branch of Rockhouse the Elkhorn coal is partially cut out by the overlying slaty shale, but 300 yards up the branch it is 4 feet thick.

## Elkhorn Coal on the Right of Main Rockhouse, ¼ Mile Above Big Branch.

Hard slate roof.....	7 ft.
Clean coal .....	45"
Thin sandstone and shale .....	20 ft.
Coal, thin.	

The thin coal, which occurs 20 to 30 feet below the Elkhorn, is shown in the following section on Big branch, ¼ mile up:

Section on Big Branch.	
Sandstone .....	25 ft.
Slate ..	3 ft.
Elkhorn rider .....	24"
Siliceous shale .....	30 ft.
Elkhorn coal .....	40"
Siliceous shale .....	20 ft.
Coal ..	18"

A section was obtained on the left of the main creek, 1 mile above Big branch, where the coal below the Elkhorn has the following thickness:

## Section on Rockhouse 1 Mile Above Big Branch.

Elkhorn coal.	
Covered .....	20 ft.
Sandstone .....	10 ft.
Coal .....	1¾"
Black shale .....	2¾"
Coal ..	23"

## Section on Lower Mill Creek.

Sandstone .....	15 ft.
Shale .....	15 ft.
Sandstone .....	20 ft.
Siliceous shale .....	15 ft.
Sandstone .....	15 ft.
Coal .....	20"
Siliceous shale .....	25 ft.
Elkhorn coal ..	41"
Clay ..	12"
Sandstone ..	9 ft.
Hard sandstone .....	20 ft.

On the left of Rockhouse,  $1\frac{1}{4}$  miles above Deane, the Elkhorn coal is 42 inches thick without parting.

One-half mile further up, the Elkhorn is opened at water level showing 26 inches of coal exposed, with  $17\frac{1}{2}$  inches of coal 20 feet higher under a massive sandstone.

## CAMP BRANCH.

## Section on Little Sandlick Branch of Camp Branch.

Fire-clay coal...	Coal .....	36"	} Elev. 1696 A. T.
	Flint fire-clay .....	$4\frac{1}{2}$ "	
	Coal ..	12"	
Covered .....		65 ft.	
Whitesburg coal	Black slate .....	8"	}
	Coal .....	44"	
	Clay.		
Covered, sandstone in part .....		50 ft.	
Sandstone .....		40 ft.	
Shale .....		20 ft.	
Sandstone .....		10 ft.	
Shale .....		40 ft.	
Coal, thin.			
Sandstone .....		25 ft.	
Coal, thin.			
Covered .....		15 ft.	
Sandstone .....		5 ft.	
Coal .....		6"	
Covered .....		110 ft.	
Sandstone .....		20 ft.	
Coal.			
Shale, siliceous ..		30 ft.	
Elkhorn coal	Coal ..	23"	}
	Shale ..	$\frac{1}{2}$ "	
	Coal ..	$24\frac{1}{2}$ "	
Siliceous shale ..		25 ft.	
Coal ..		10"	

The above section was made along the road from the gap between Sandlick creek and Little Sandlick branch of Camp branch to Polly.

Samples of coal from the Fire-clay and Whitesburg beds were collected giving the following:

## Analyses of Fire-clay and Whitesburg Coals.

Laboratory No. G-3697, Fire-clay coal, head of Camp branch.  
Average sample.

Analysis—Per cent	Air-dried	As received
Moisture .....	1.40	2.63
Volatile combustible matter .....	38.12	37.64
Fixed carbon .....	55.39	54.70
Buff colored ash .....	5.09	5.03
Total .....	100.00	100.00
Sulphur .....	.74	.73
B. T. U. per pound ..	14,040.00	13,860.00
Specific gravity ..	1.311	
Moisture lost by air drying .....		1.25

Laboratory No. G-3696, Whitesburg coal, head of Camp branch.  
Average sample.

Analysis—Per cent	Air-dried	As received
Moisture ..	1.70	3.64
Volatile combustible matter .....	35.97	35.26
Fixed carbon .....	56.23	55.12
Gray ash .....	6.10	5.98
Total .....	100.00	100.00
Sulphur .....	.79	.77
B. T. U. per pound .....	13,730.00	13,460.00
Specific gravity ..	1.266	
Moisture lost by air drying ..		1.97

## TRACE FORK.

A section on the first left branch of Trace fork was made as given below.

## Section on Trace Fork.

Hindman Coal.	
Covered interval, sandstone at bottom . . . . .	130 ft.
Flag coal.	
Sandstone at top and bottom, covered between.....	225 ft.
Sandstone interval . . . . .	130 ft.
Fire-clay coal...	<div> <div>Coal .....39¾"</div> <div>Flint clay ..... 3"</div> <div>Coal .....11"</div> </div>
Elev. 1475 A. T.	
Covered, with sandstone at top and bottom.....	140 ft.
Shale . . . . .	20 ft.
Covered .. . . .	35 ft.
Coal, thin.	
Shaly sandstone . . . . .	20 ft
Coal . . . . .	26"
Shale . . . . .	25 ft.
Sandstone . . . . .	35 ft.
Shale and sandstone .. . . .	70 ft.
Elkhorn coal	<div> <div>Shale. ....</div> <div>Coal . . . . .19"</div> <div>Shale . . . . . 1"</div> <div>Coal . . . . . 1"</div> <div>Shale . . . . . 1"</div> <div>Coal . . . . .15"</div> </div>
37"	

## BUCK CREEK.

The Fire-clay coal is opened on the Jasper Collins place, 2 miles up, as shown in the following section:

## Fire-clay Coal.

Shale.	
Coal, hard .....	40"
Flint fire-clay .....	4"
Clean coal .....	15¾"
Elevation, 1525.	

The coal underlies a large area in this region and both top and bottom benches are workable.

The Amburgy and a coal 35 feet below it, outcrop on the main creek. The former is 210 feet below the Fire-clay bed.

On the left of Rockhouse, ½ mile above Buck creek, the Elkhorn coal is opened at an elevation of 1165 feet with 37 inches of coal with a thin clay parting near the center.

At Elam Pigman's on Rockhouse, 1 mile above Buck creek, the Elkhorn coal is opened on the right, about 20 feet above the stream, with a clean face of coal 43 inches in thickness.

## BEAVERDAM BRANCH.

In the section below, the Fire-clay rider forms the thickest coal opened on this branch. The rider here comes down within ten feet of the Fire-clay coal. The latter has been opened at Naman Taylor's, ⅝ mile up, and is reported 5½ feet thick, including 4 inches of flint clay parting. At the same place the rider is reported 5 feet thick and the Whitesburg coal 3 feet.

## Section on Beaver Dam Branch.

Massive, cliff-forming sandstone . . . . .	20 ft.
Place of Hazard coal, not opened.	
Covered . . . . .	100 ft.
Fossiliferous limestone, slightly slipped.	
Covered . . . . .	210 ft.
Shale . . . . .	10 ft.
Fire-clay rider coal ..	<div> <div>Shale. ....</div> <div>Coal . . . . . 7"</div> <div>Shale .. . . . 18"</div> <div>Shale and coal. 11"</div> <div>Coal . . . . . 19½"</div> <div>Shale . . . . . ¼"</div> <div>Coal . . . . . 2½"</div> <div>Shale . . . . . ½"</div> <div>Coal .. . . . 12"+</div> </div>
Shale . . . . .	10 ft.
Fire-clay coal, reported . . . . .	65"
Covered .....	45 ft.
Whitesburg coal, reported .....	3 ft.
Covered .....	80 ft.
Sandstone . . . . .	15 ft.
Shale . . . . .	60 ft.
Amburgy coal, reported ... . .	3 ft

The elevation of the Fire-clay coal is 1505 feet barometric reading, which is perhaps 25 to 30 feet too low.

#### INDIAN CREEK.

Two openings have been made on the Fire-clay coal on this creek, one at Steve Sergeant's on the right of the first left branch  $\frac{1}{2}$  mile up, where the upper bench is only 24 inches thick with  $16\frac{1}{2}$  inches below the flint clay parting. The lower bench has a  $1\frac{1}{2}$  inch clay parting 4 inches from the bottom. The elevation of the coal is 1677 feet.

The same coal is opened on the right of the gap to Millstone with following section:

Fire-clay Coal.	
Shale.	
Coal	36"
Flint fire-clay	4"
Coal	$12\frac{1}{2}$ "
Slate	1"
Coal	$5\frac{1}{4}$ "
Slate and coal	2"
Cannel coal	4" +
Elevation, 1663.	

#### LOVE BRANCH.

On the left,  $\frac{1}{2}$  mile up, four coals have been opened on William Profit's land but only the lower one was open at the time of the writer's visit. Mr. Profit, who opened the coals, reports 66 inches, including 4 inches of flint clay parting, for the total thickness of the Fire-clay coal and 54 inches of clean coal for the Fire-clay rider. The intervals between the beds are shown in the following section:

Section at William Profit's.		
Fire-clay rider, reported	54"	Elev. 1540 ft. A. T.
Shale interval	25 ft.	
Fire-clay coal, reported	66"	
Interval	65 ft.	
Whitesburg coal.		
Interval	140 ft.	
Coal	$26\frac{1}{2}$ "	

The Fire-clay coal  $\frac{1}{2}$  mile further up, on the left, at S. H. Kiser's is opened with the following section:

#### Fire-clay Coal.

Shale.	
Coal	$38\frac{1}{2}$ "
Flint fire-clay	$3\frac{1}{2}$ "
Coal	$22\frac{1}{2}$ "
Clay floor.	
Elevation, 1540.	

As shown in the section the parting is far up toward the center of the coal, giving a valuable lower bench that can be worked. The coal here is one of the thickest of this seam in the county and the large area it underlies makes it a valuable seam of coal.

The thick 72-inch solid coal at this place given by Mr. Hodge\* as the Fire-clay coal, is evidently intended for the Fire-clay rider, as that is the thickness reported for the latter coal by Mr. Kiser who opened it for Mr. Hodge.

#### BIG BRANCH.

The Fire-clay rider, which, on Love branch, is reported 72 inches thick has thinned to the following section on Big branch:

Section on Big Branch.

	Slate	10"	} ... 63¼"
	Coal	6"	
	Clay .. .	12"	
Coal, Fire-clay rider (?)...	Coal	1"	
	Shale	2½"	
	Coal	2"	
	Clay	1¼"	
	Coal	28½"	
Sandstone interval, in part...			... 70 ft.
	Slate.		} Elev. 1615 A.T. 29¾"
	Coal . . .	1½"	
Coal, Fire-clay (?)...	Shale . . .	¾"	
	Coal	2"	
	Shale and coal	1½"	
	Coal .....	24" +	

The bottom of the lower coal was not seen. The lower bench is reported over 6 feet thick without the flint clay parting. There is some doubt of the correlation of the two coals given in the section. No flint clay parting is reported in the lower bed, and the interval up to the

\*Bull. 13, Ky. Geol. Survey, page 142.

next coal is 45 feet greater than the interval between the Fire-clay coal and its rider in two places on Love branch 1 mile to the west.\* In this region at least, wherever the flint clay parting is absent, there is some doubt of the coal being the Fire-clay seam.

## MILL CREEK.

The excellent thickness of the Fire-clay coal on Love branch has thinned to that shown in the general section on Mill creek. The opening where the section of the coal was measured was on the left of a left branch of the right fork, at an elevation of 1700 feet. The general section was made along the road from the head to the mouth of the stream.

Section on Mill Creek.		
Sandstone .....		20 ft.
Coal, Fire-clay.....	Black shale.	
	Coal .....	1½"
	Bone .....	¾"
	Coal ..	25¼"
	Flint clay .....	3¼"
	Coal .....	10"+
Sandstone and shale .		14 ft
Covered		18 ft.
Massive sandstone		32 ft.
Covered, sandstone at bottom .		78 ft
Shale ..		51 ft
Sandstone and shale .....		14 ft
Coal.....	Coal	1"
	Shale .	1"
	Coal	¾"
	Shale .	1"
	Coal	1"
	Shale .	20"
	Coal	20"+
Sandstone .		33 ft.
Shale .		47 ft.
Sandstone .		14 ft.
Shale .		14 ft.
Sandstone .		28 ft.
Shale .		14 ft.
Sandstone		14 ft.
Coal		20"
Shale		23 ft.
Coal, Elkhorn.		

\*These may be the rider and the Hamlin coals. J. B. H.

## STEPHENS FORK.

One mile up, on the left, the Fire-clay coal is opened as follows:

## Fire-clay Coal.

Shale.	
Coal .	34"
Flint clay . . .	4½"
Coal .	7"
Hard shale .	1"
Coal	4"
Hard shale .	¾"
Bony splint .	6"+
Elevation, 1770.	

A somewhat similar section of the same coal is given by Mr. Hodge\* near the head of the left fork.

## Fire-clay Coal.

Shale.	
Coal .	34"
Flint clay .	3"
Coal .	12"
Jack rock .	2"
Coal .	10"
Bone coal .	(?)

## TOLSON BRANCH OF NORTH FORK.

The Elkhorn coal which separates into two benches of about 30 inches each with 8 to 10 feet of shale between, on coming down North fork, sinks below drainage between Tolson branch and the mouth of Rockhouse.

On the right of a right branch 1 mile up Tolson, the Fire-clay coal is opened as follows:

## Fire-clay Coal.

Shale, dark.	
Coal	18"
Splint .	1½"
Coal .	10½"
Flint clay.	
Elevation, 1435.	

The same coal occurs near the crest of the divide between Tolson and Big branch, at an elevation of 1520.

\*Bull. No. 11, Ky. Geol. Survey, page 147.

## MILL BRANCH.

The following section of the strata exposed from the head to the mouth of this branch, indicates the Fire-clay coal as the one of most value in this region. It is the one generally mined for domestic use, although some of the lower coals have been opened.

Section on Mill Branch.		
Coal, Fire-clay..	Shale.	
	Coal . . . . .	7"
	Shale . . . . .	3"
	Coal . . . . .	3½" Elev. 1446 A. T.
	Shale . . . . .	1½"
	Coal . . . . .	47"
	Flint clay.	
Sandstone		50 ft.
Covered		5 ft
Coal, Whitesburg .		24" +
Sandstone		5 ft.
Shale		6 ft.
Shaly sandstone		34 ft.
Massive sandstone		80 ft.
Siliceous shale		80 ft.
Coal, reported.		
Sandstone		60 ft.
Coal		14"
Siliceous shale or sandstone		40 ft
Sandstone		10 ft
Coal, Elkhorn.		
Sandstone		30 ft

The place of the Fire-clay coal as given in the section is on the right 1¾ miles up. Another opening on the right ¾ mile up, is at an elevation of 1436 feet.

## KINGS CREEK.

The Fire-clay coal which, on so many of the streams in the northern and western parts of the county, forms the principal source of fuel for local use, was only seen in one place on Kings creek, on the right of Big Bottom branch, ½ mile up, where the opening was so badly fallen in that no measurements were possible. At this place it was at an elevation of 1560 feet above sea level.

The Elkhorn coal occurs a few feet above the level of the creek up to the head, where the thick cannel coal as described by Mr. Hodge\* occurs. Only the top of the cannel seam is now exposed. Mr. Hodge's section of this bed shows 56 inches of cannel overlying 24 inches of bituminous coal. It occurs at the same horizon as the cannel coal on Dry fork of Line fork and on the latter stream at Joe Cornett's.

A coal known to the coal men as Slate No. 1 and designated in this report as the Hamlin coal, is the thick coal generally used for domestic coal on Kings creek and Kingdom Come. It occurs about 60 feet above the horizon of the Fire-clay coal.

The Amburgy coal or the vein 30 to 40 feet below it, is opened in a few places and mined for local use.

**BIG BOTTOM BRANCH.**—The following section was made in the bed of the branch from the Fire-clay coal to the mouth of the branch:

Section on Big Bottom Branch.		
Old opening on Fire-clay coal, elevation, 1560 ft. A. T.		
Interval		70 ft
Coal, Whitesburg	Black slate	36"
	Bone	6"
	Clay	8"
	Coal	22" +
Sandstone, in part covered		80 ft
Sandstone		40 ft.
Covered, perhaps shale		60 ft
Sandstone		45 ft
Shale		15 ft
Sandstone		45 ft
Shale		20 ft.
Sandstone		10 ft.
Shale		10 ft
Sandstone		25 ft
Coal		24"
Sandstone		15 ft
Coal at water level in creek.		

**MUDDY BRANCH.**—Mr. C. H. Burton, of the Swift Coal and Timber Company, opened the Fire-clay coal on

\*Report above cited, page 148.

the right,  $\frac{1}{2}$  mile up, and reports 37 inches of coal above 4 inches of flint clay.

**LYNN BRANCH.**—On the left of the left fork near the divide to Kingdom Come creek, the Hamlin coal is opened with the following section:

Hamlin Coal.	
Shale containing impressions of ferns, etc	60"
Coal	1"
Knife edge parting.	
Coal	7"
Clay with bands of coal up to 1" thick	7-10"
Clay, slickensided	7½"
Coal	1"
Clay, same as above	7"
Coal	36"+
Elevation, 1629.	

On the hillside below and a short distance to the north, a coal 24 inches in thickness occurs 100 feet below the Hamlin coal.

A coal on the right of the branch,  $\frac{1}{2}$  mile up, was measured with the following bed section. This apparently is a coal below the Amburgy bed:

Section of First Coal Below the Amburgy.	
Sandstone with iron concretions in lower part.	
Coal	2"
Hard shale	24"
Coal	10"
Slickensided clay	14"
Coal	12"
Hard shale floor.	

**CARRION BRANCH.**—On the left,  $\frac{1}{2}$  mile up, the Hamlin coal shows the following bed section at the mouth of a wet entry:

Hamlin Coal.	
Shale.	
Coal	5½"
Clay	6"
Coal	2"
Clay	6"
Coal	2"
Clay	17"
Coal, bottom covered	36"
Elevation, 1640.	

A coal 45 feet below the Amburgy and 315 feet below the Hamlin coal, is opened on the left of the creek opposite the mouth of Carrion branch.

#### Section of First Coal Below Amburgy.

Sandstone.	
Shale	2"
Coal	6½"
Shale	4½"
Coal	24"

**FUGATE BRANCH.**—On the left of the first left branch of Fugate, a coal is opened at an elevation of 1357 feet. The coal is badly cut up with partings as shown in section below:

#### Section on Left Branch of Fugate Branch.

Sandstone	20 ft.
Shale	8 ft.
Coal	
Coal	1"
Clay	2"
Coal	¾"
Clay	5"
Coal	8½"
Bone	1½"
Coal	18"
Coal...	Clay ½"
	Coal 1½"
	Clay 1"
	Coal 2½"
	Clay ½"
	Coal ½"
	Shale ½"
	Coal ¼"
	Shale bottom.
Sandstone	25 ft.
Coal	16"
Shale	5 ft.
Sandstone and shale	50 ft.
Coal	30"
Shale	15 ft.



The thick coal in the section above is opened on the left of the left fork of Kings creek,  $\frac{1}{4}$  mile up, where the bed presents a better appearance.

#### Section on Left Fork

Shale ..	.....	7 ft.
Coal .	Coal ..	7"
	Bone ..	2"
	Coal ..	24"
	Clay ..	1½"
	Coal ..	3"
	Shale bottom.	
Sandstone ..	.....	30 ft.
Coal, thin.		
Shale .		50 ft.
Sandstone and shale ..		30 ft.

#### SMOOT CREEK.

The Elkhorn coal occurs about 20 feet above the bed of the river at the mouth of Smoot, and disappears below drainage a short distance up Smoot. It is too thin to be of commercial value on this stream. For 25 to 30 feet above the Elkhorn bed is a siliceous shale overlain by about 50 feet of sandstone. Overlying the sandstone is a bed of shales 45 feet or more in thickness. These shales are typically developed on Beetree branch of Smoot, and are therefore referred to in numerous places in this report as the "Beetree shales." These shales carry numerous calcareous concretions, some of which are 5 feet or more in diameter and about 12 inches in thickness. They are composed of very fine, calcareous silt and are of a gray-blue color on fresh fracture. Thin streaks of iron oxide occur parallel to the bedding plane and give them a distinctive appearance. These concretions are referred to as "cartwheel concretions." Other shales carry similar concretions but not in such quantities and size. Marine fossils and plant remains occur in profusion in the shales on Beetree branch.

On the right of the first left branch,  $\frac{1}{2}$  mile up Smoot, the Amburgy coal is opened as follows:

#### Amburgy Coal.

1. Black slate roof.	
2. Coal .....	1¼"
3. Bony splint .....	2½"
4. Hard bright coal .....	17"
5. Splint or bone .....	4"
6. Hard bright coal .....	17½"
7. Bone .....	½"
8. Hard bright coal .....	10"
9. Bone .....	¼"
10. Hard coal .....	1½"
Elevation, 1225.	

The following is an analysis of the above coal, excluding Nos. 1, 2, 3 and 9:

#### Analysis of Amburgy Coal.

Laboratory No. G-3712, Amburgy Coal,  $\frac{1}{2}$  mile up Smoot creek.  
Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.45	2.16
Volatile combustible matter .....	34.00	33.75
Fixed carbon .....	56.28	55.88
Lilac ash .....	8.27	8.21
Total .....	100.00	100.00
Sulphur .....	.98	.97
B. T. U. per pound .....	13,500.00	13,400.00
Specific gravity . .	1.369	
Moisture lost by air drying .....		.72

Thirty-five to 40 feet below the Amburgy coal is a coal which on Smoot is thin, but on Kings creek and elsewhere becomes a more prominent bed than the Amburgy. On Smoot creek the Amburgy coal is the thick coal though it changes in character. It may be distinguished from the lower one by a heavy sandstone close above.

JOHNSON BRANCH.—The Amburgy is opened again near branch level on Johnson branch,  $1\frac{1}{4}$  miles up it, with the following bed section:

**Amburgy Coal.**

Shale roof containing marine fossils.	
Coal .....	4"
Bone .....	2"
Coal .....	18"
Sulphur band .....	¾"
Coal .....	7"
Shale bottom.	

On the right, 2 miles up and 225 feet above the Amburgy opening, the Fire-clay coal is opened.

**Fire-clay Coal.**

Shale.	
Coal .....	38"
Flint fire-clay .....	4"
Coal .....	14"
Elevation, 1450.	

On the right of a left branch of Smoot, ¾ mile below the mouth of Beetree branch, the bed section of the Amburgy coal at the mouth of a flooded entry is given below:

**Amburgy Coal.**

Black, sandy shale containing marine fossils.

Coal .....	6"
Bone .....	3"
Coal .....	27"

Elevation, 1274

Continuing the section below.

Shale and sandstone .....	45 ft.
Sandstone .....	35 ft.
Beetree shales .....	55 ft.
Sandstone .....	25 ft.

The same coal is opened at B. F. Frazier's on the left of Smoot, ¼ mile below the mouth of Beetree branch.

**Amburgy Coal.**

Shale roof containing marine fossils.	
Coal .....	11¼"
Bone sulphur .....	1½"
Bone, perhaps coal further in .....	4½"
Coal to water's edge .....	24"
Elevation, 1275.	

**BEETREE BRANCH.**—The Fire-clay coal has a fine showing on Will Banks' place on the left, 1 mile up, and again ½ mile further up on same hillside.

**Fire-clay Coal.**

1 Mile Up.	1½ Mile Up.
Shale.	Shale.
Coal .....	Coal .....
Flint fire-clay .....	Flint fire-clay .....
Coal .....	Coal .....
Elevation, 1460.	

A sample of coal was collected from the latter opening and analyzed, excluding the flint clay parting. The two benches were sampled and analyzed separately.

**Analyses of Fire-clay Coal.**

Laboratory No. G-3714, Fire-clay coal, Beetree branch of Smoot creek, top bench. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.41	2.31
Volatile combustible matter .....	35.02	34.70
Fixed carbon .....	56.31	55.80
Lilac ash .....	7.26	7.19
Total .....	100.00	100.00
Sulphur .....	.92	.91
B. T. U. per pound .....	13,825.00	13,700.00
Specific gravity .....	1.327	
Moisture lost by air drying .....		.91

Laboratory No. G-3713, Fire-clay coal, Beetree branch of Smoot creek, lower bench. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.33	2.04
Volatile combustible matter .....	35.47	35.23
Fixed carbon .....	57.94	57.56
Almost white ash .....	5.21	5.17
Total .....	100.00	100.00
Sulphur .....	.68	.68
B. T. U. per pound .....	14,010.00	13,920.00
Specific gravity .....	1.295	
Moisture lost by air drying .....		.67

The difference in the ash content of the upper and lower benches is due, in part, to an imperfect roof, which had permitted siliceous material to enter the upper bench between the cracks of the coal. This was impossible below the flint fire-clay parting.

The following section was made from the gap at the head of Beetree branch to the mouth:

Section on Beetree Branch.

Shaly sandstone	80 ft.
Fossiliferous limestone	3 ft.
Shaly sandstone	40 ft.
Coal.	
Sandstone	30 ft.
Shale	5 ft.
Coal stain.	
Sandstone	25 ft.
Coal stain.	
Shale	50 ft.
Covered	130 ft.
Shale	10 ft.
Coal, Fire-clay.	
Sandstone	20 ft.
Covered	70 ft.
Sandstone	65 ft.
Shale, sandy	10 ft.
Shale	25 ft.
Coal, Amburgy.	
Shale	25 ft.
Sandstone	12 ft.
Coal, thin.	
Shale	4 ft.
Coal	1 ft.
Shale, "Beetree"	45 ft.
Sandstone	10 ft.

On the left of Smoot, 1 mile above the mouth of Beetree branch, at Mr. Wesley Combs', the Amburgy coal is 37 inches thick, including 4 inches of bone 11 inches from the top.

On the right at the same location, the Whitesburg coal is opened, with an old opening on the Fire-clay coal 60 feet higher. The latter coal here has thinned and the Whitesburg becomes the thicker coal.

Whitesburg Coal.

Black slate roof.	
Coal	5"
Shale	2"
Coal	2"
Sulphur bone	1"
Coal	29"
Shale.	
Elevation, 1520.	

TRACE FORK.—On the left,  $\frac{1}{2}$  mile up, the Fire-clay coal is opened. At the face of a 15-yard entry the bed section is as follows:

Fire-clay Coal.

Shale	
Coal	30"
Flint fire-clay	$3\frac{1}{2}$ "
Coal	17"
Elevation, 1525.	

The full thickness of the same coal at Shade Combs', on the right 1 mile up, was 49 inches, including 3 inches of flint clay parting. The elevation of the coal there is 1534 feet.

The Whitesburg coal is opened on the left of Smoot,  $\frac{3}{4}$  mile above the mouth of Trace fork, with the following bed section:

Whitesburg Coal

Black slate roof.	
Coal	25"
Shale	1"
Coal	14"
Elevation, 1490.	

On the same hillside and 160 feet lower, the Amburgy coal is  $31\frac{1}{2}$  inches thick.

The Whitesburg coal is opened on the right of the gap leading to Cow branch of Little Colly at an elevation of 1540 feet, and again on the left of Smoot near the head. At the former place the coal is  $33\frac{1}{2}$  inches of bituminous coal and 1 inch of cannel coal at the top. At the head of the creek it contains 34 inches of clean coal with 4 inches of bone at the top. Elevation of the coal 1620 feet.

## KINGDOM COME CREEK.

The Elkhorn coal occurs above drainage on this creek to a point about half way between Stillhouse and Cottonpatch branches. The two benches of which it consists are each too thin to be worked separately, and are too far apart to be operated as one vein.

**FRAZIER BRANCH.**—On the left, 1 mile up, the Hamlin coal is opened.

Hamlin Coal.	
Shale.	
Coal .....	1"
Shale .....	5"
Coal, reported, with 1 inch parting 1 foot from bottom .....	66"
Sandstone .....	40 ft.
Shale .....	5 ft.
Coal .....	32¾"
Elevation, 1595.	

**ALFRED BRANCH.**—Mr. Straub reports a coal on the right near the head of the branch, where the following section was taken:

Hamlin Coal.	
Dark shale .....	2"
Coal .....	1"
Clay .....	½"
Coal .....	7"
Clay .....	8"
Coal .....	1"
Clay .....	2½"
Coal .....	1½"
Clay .....	8"
Coal, bottom in water .....	24"+
Elevation, 1611.	

One-fourth mile up a right branch of the main creek, ½ mile below Cottonpatch branch, Mr. Straub reports the same coal.

## Hamlin Coal.

Shaly sandstone.	
Coal . . . . .	7"
Clay . . . . .	8"
Coal . . . . .	1"
Clay . . . . .	3½"
Coal . . . . .	1"
Clay . . . . .	8"
Rash and clay . . . . .	2½"
Coal . . . . .	34½"
Clay . . . . .	1½"
Coal, bottom covered..	12"
Elevation, 1657.	

**COTTONPATCH BRANCH.**—In the following section of this branch the thick coal is that of the Hamlin bed. The coal 33 feet lower is the Fire-clay rider. It occurs in the section on Frazier branch 45 feet below the Hamlin and is there about 20 feet above the Fire-clay coal. The rider has its greatest development on Kingdom Come, Kings creek and Cowan, seemingly where the Hamlin coal is thickest. The Fire-clay and Whitesburg coals were both opened just below where the rider is opened, but the openings were filled when visited.

Section from the Head to Mouth of Cotton Patch Branch.

Sandstone .....	30 ft.
Covered ..	55 ft.
Flaggy sandstone .....	10 ft.
Covered ..	10 ft.
Sandstone, hard .....	2 ft.
Shaly sandstone .....	40 ft.
Sandstone .....	15 ft.
Shale .....	15 ft.
Coal, Hamlin.....	Shale.
	Coal ..... 2"
	Clay ..... 2"
	Coal ..... 31" 1700 A. T.
	Clay ..... 1½"
	Coal ..... 6"
	Splint ..... 9"+
Sandstone and covered .....	25 ft.
Sandstone .....	4 ft.
Shale .....	1 ft.
Coal, bottom covered .....	18"
Massive sandstone .....	22 ft.
Covered ..	60 ft.
Bench of Whitesburg coal.	
Sandstone and covered ..	40 ft.
Shale ..	55 ft.
Sandstone ..	30 ft.
Coal ..	Coal .. 8"
	Black slate .. 2"
	Coal ..... 12"
Shale ..	12 ft.
Sandstone ..	60 ft.
Coal ..	12"
Shale ..	40 ft.

DAY FORK.—The Hamlin coal is opened on William Ison's land at the head of the right fork.

Hamlin Coal.

1. Shale.
2. Coal .. 18"
3. Rasby clay .. 1"
4. Coal ..... 1½"
5. Clay ..... 1"
6. Coal ..... 24"
7. Clay ..... 1"
8. Coal .. 48"
9. Clay bottom.

Elevation, 1675.

A sample of the above coal was collected for analysis excluding numbers 3, 4, 5, 7 and 9.

Analysis of Hamlin Coal.

Laboratory No. G-3736, Hamlin coal, Head of Kingdom Come.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.52	2.10
Volatile combustible matter .....	37.44	37.22
Fixed carbon .....	55.71	55.38
Ash .....	5.33	5.30
Total .....	100.00	100.00
Sulphur .....	0.87	0.86
B. T. U. per pound.	13,515.00	13,435.00
Specific gravity ..	1.277	
Moisture lost by air drying ..		0.59

RIGHT FORK.—On the left, ¼ mile up, what is known locally as the "Lap Vein," is opened as follows:

Lap Vein.

Shale.
Coal .. 1½"
Black shale .. 1½"
Coal .. ½"
Clay ... 6"
Black slate 1"
Coal ..... 18½"
Shale ..... 8½"
Coal .. 10"
Cannel coal .. 8"
Shale floor.

Elevation, 1460.

On the right of a right drain, ½ mile up, the Hamlin coal is opened.

Hamlin Coal.

Shale.
Coal .. 7"
Clay ..... 5"
Coal .. 1"
Clay ..... 1½"
Coal .. 1"
Clay ..... 20½"
Coal, hard ..... 40"
Clay .. 1½"
Coal ..... 5½"

Elevation, 1678.

The same coal is opened at the head of the Right fork.

**Hamlin Coal.**

Shale.	
Coal .....	4"
Shale .....	¾"
Coal .....	35½"
Rash and shale ..	4½"
Coal .....	2"
Clay .....	1½"
Coal .....	8½"
Splint .....	8"
Shale.	
Elevation, 1710.	

On the first small branch on the left of North fork of Kentucky river, below Uz, the Elkhorn coal is opened, on the right, ¼ mile from the river.

**Elkhorn Coal.**

Thin bedded sandstone.	
Clean coal .....	21"
Gray clay .....	9-11"
Coal .....	1½"
Shale .....	12"
Coal .....	1¼"
Shale .....	10"
Coal .....	1½"
Shale .....	2"
Coal .....	21½"

Further up the same coal shows:

Coal .....	22"
Clay shale .....	9"
Coal .....	3"
Shale .....	5"
Coal .....	1"
Shale .....	2"
Coal, bottom covered..	18"

Twenty feet below, with a rotten sandstone between, is a coal 24 inches thick. It is interesting to note in the sections of the Elkhorn coal from here to the head of the river how the upper and lower benches, which in this

locality are about 21 inches thick, thicken and the clay parting thins. The full thickness of the bed here is about 80 inches, about half of which is clay and shale, containing bands of coal. Further up the river the parting generally carries two thin bands of coal.

**DRY FORK OF NORTH FORK.**

The Elkhorn, Fire-clay and Whitesburg beds are well developed on this stream and form the source of domestic coal. The three coals are of sufficient thickness to be worked on a commercial basis, the Elkhorn and Fire-clay beds for immediate use and the Whitesburg bed for future supply. The Elkhorn contains a large area lying only a few feet above drainage up the main stream to the mouth of Loggy Hollow, where it sinks below drainage. The Whitesburg and Fire-clay coals, while high in the hills, have sufficient cover to give a fairly large acreage.

**STEVENS BRANCH.**—On the left of the left fork of Stevens branch the Fire-clay coal is opened.

**Fire-clay Coal.**

Massive sandstone.	
Shale .....	6 ft.
Coal .....	6"
Shale .....	6"
Hard coal, bottom covered .....	.30"+
Elevation, 1565.	

The entire bed is reported 76 inches with 4 inches of flint clay parting. The Whitesburg coal is opened in a drain ⅛ mile to right and about 60 feet below, with 36 inches of coal under a black slate roof.

In the first drain to the left and 135 feet below the Whitesburg, the Amburgy coal is 22 inches thick.

The Elkhorn coal is opened on the left of the first large branch of the main creek near where it sinks below drainage.

## Elkhorn Coal.

Shale.	
{ Coal	21"
{ Clay	18"
{ Coal	10"
{ Clay	3"
{ Coal	15"
Shale bottom	10 ft.
Sandstone	10 ft.
Coal	12"
Elevation, 1178.	

Further up Dry fork the lower 3-inch clay parting in the above section disappears giving 23 inches of coal in the lower bench, 6 inches of clay and 18½ inches of coal above.

LOGGY HOLLOW.—On the right of the gap to Smoot creek, near the road, the Whitesburg coal is opened.

## Whitesburg Coal.

Shale	5½"
Black shale	½"
Coal	12"
Bone	1"
Coal	18"
Clay floor.	
Elevation, 1536.	

The same coal is reported by Mr. Straub, 1 mile up the main branch, ¼ mile up a right drain, at an elevation of 1554 feet. The bed section shows 46 inches of coal with 2 to 4 inches of bone at the bottom and a black slate roof. One-fourth of a mile further up the main branch, near the head of a left branch, Mr. Straub found the same coal 41 inches thick, 23 inches of which is splint. Elevation 1569 feet. Near the head of Main Loggy Hollow, on the left, still another opening on the Whitesburg bed shows 34 inches of splint and 8 inches of hard coal, at an elevation of 1529 feet.

The Amburgy coal is opened in a number of places on the main creek above the mouth of Loggy Hollow and shows from 30 to 36 inches of coal, with 2 inches of bone in places, 12 inches from the bottom.

A small branch enters Dry fork on the right 1¼ miles above the mouth of Loggy Hollow. On the right of the first left drain of this branch there is a prospect opening on the Fire-clay coal which has the following section:

## Fire-clay Coal.

Shale.	
Rashy coal	5"
Clay, slickenseit	12"
Coal	25"
Flint fire-clay	3"
Coal	19"
Elevation, 1675.	

At the head of Dry fork, on the right, the Whitesburg coal at an elevation of 1635 feet, shows 44½ inches of clean coal.

On the right of North fork, at the mouth of Cowan creek, the Hamlin coal is opened. The following bed section was made at the mouth of a flooded entry:

## Hamlin Coal.

Dark shale.	
Coal	2"
Shale	18"
Coal	36"
Shale	1"
Coal, bottom covered	18"
Elevation, 1625.	

Continuing the section in a branch 100 yards to the right.

Massive sandstone	35 ft.
Shale	0-12"
Coal	33"
Hard shale	2"
Sandstone	30 ft.
Place of Fire-clay coal.	
Shale	30 ft.
Coal	10"
Shale	10 ft.
Shaly sandstone	10 ft.
Coal	6"
Sandstone	15 ft.
Shale and sandstone	20 ft.
Coal	
Massive sandstone	65 ft.
Sandy shale	50 ft.
Massive sandstone	20 ft.
Covered	10 ft.
Massive sandstone	30 ft.
Covered, shale and thin sandstone	65 ft.
Coal.	
Covered	85 ft.
Coal, Elkhorn.	

## COWAN CREEK.

The Elkhorn coal, at the mouth of this creek, is 60 feet above the bed of the creek and continues above drainage to a short distance below Mandrake on main Cowan and for a distance of about 2 miles up Little Cowan. Just below Mandrake on the left of Cowan, the Elkhorn bed shows the following section:

Elkhorn Coal.	
Shale.	
Coal .....	6½"
Clay .....	4"
Coal .....	31"
Shale bottom.	

Just below, with an interval of 12 feet, is a coal 18 inches thick, and 30 feet below is an 18-inch coal, opened on the opposite side of the creek.

The Elkhorn rider is opened on the right of the trail leading over the divide to Little Cowan, 30 feet above the Elkhorn bed, with 26 inches of coal.

Two exposures of the Fire-clay coal were found on the north slope of Pine mountain, one on the Whitesburg-Stonega road at the head of Little Cowan creek, at an elevation of 1840 feet; and the other at the head of the right fork of Cram creek at an elevation of 1925 feet. A two-yard entry on the coal at the latter place shows 35½ inches of coal above the flint fire-clay.

A number of openings have been made on the Fire-clay coal and the Hamlin bed on the waters of Cowan, but were all closed at the time of the writer's visit. On the right of Grapevine branch, which is on the right ½ mile above the mouth of Little Cowan, the Hamlin coal has been opened. The following bed section is reported by Mr. C. H. Burton of the Swift Coal and Timber Company:

Hamlin Coal.	
Shale.	
Draw slate .....	6"
Coal . . . . .	18"
Clay parting .....	3"
Coal . . . . .	36"
Shale.	
Elevation, 1700.	

## LITTLE COWAN CREEK.

From the crest of the ridge between North fork and Little Cowan creek, the following section was made on the public road which leads from near the mouth of Little Cowan to Whitesburg:

## Section on Left of Little Cowan Creek.

Coal in the gap, elevation 1720 feet A. T.....	24"
Shale .....	5 ft.
Fire-clay coal, with flint clay in place.	
Shale .....	10 ft.
Sandstone .....	5 ft.
Shale .....	10 ft.
Sandstone .....	19 ft.
Shale .. .. .	15 ft.
Coal crop.	
Covered, shale in part .....	65 ft.
Sandstone .....	50 ft.
Shale .....	15 ft.
Covered .....	20 ft.
Sandstone, massive .....	45 ft.
Shale .....	10 ft.
Sandstone .....	17 ft.
Covered .....	8 ft.
Sandstone .....	40 ft.
Covered .....	70 ft.
Siliceous shale .....	32 ft.
Coal .....	26"
Sandstone .....	8 ft.
Shale .....	15 ft.
Sandstone .. .. .	35 ft.

## SANDLICK CREEK.

The Elkhorn coal has been opened in almost every branch on Sandlick creek for a distance of 3 miles up, where it goes below drainage. In the lower part of the stream the clay parting, which is 3 feet or more in places, renders the coal almost worthless as a commercial proposition. Further up the creek the parting thins down to 10 to 12 inches. On passing through the ridge from Sandlick to Camp branch of Rockhouse, the parting thins to 1 inch or disappears entirely. The same coal in passing east to the upper part of Colly creek loses much of its hurtful parting and there becomes a valuable coal. It is



possible, therefore, that under heavy cover the coal on Sandlick will show much less parting than at the outcrop. It seems to be general that wherever the clay or shale parting is separated by several bands of coal, it makes the bed difficult to operate. Where the parting is practically free of coal the thin bands of coal appear to increase the thickness of the two main benches.

The following bed sections of the Elkhorn coal on Sandlick give an idea of the bed at or near the outcrop:

#### Elkhorn Coal on Sandlick Creek.

On the right  $\frac{1}{4}$  mile up:

Coal ..... 26"  
Slickensided clay ..... 36" +  
Coal, covered.

On the right of first left branch:

Coal . 26"  
Clay .... 8"  
Coal .  $\frac{1}{2}$ "  
Hard clay . 13"  
Coal .  $1\frac{1}{2}$ "  
Hard clay . 2"  
Coal . 10"  
Clay .  $\frac{3}{4}$ "  
Coal, part splint..... 18"

One-eighth mile up second left branch on right:

Coal ..... 29 $\frac{1}{2}$ "  
Shale ..... 1 $\frac{1}{2}$ "  
Coal .. 24" +  
Bottom covered.

On left of main creek 2 $\frac{1}{2}$  miles up:

Coal 25"  
Clay 8 $\frac{1}{2}$ "  
Coal 1 $\frac{1}{2}$ "  
Clay .. 5"  
Coal 10 $\frac{1}{2}$ "  
Clay 6"  
Coal 25"  
Shale .. 20 ft.  
Hard sandstone 5 ft.  
Coal 24"  
Shale 10 ft.  
Hard sandstone.

The Amburgy coal has not been opened on Sandlick creek. It appears at the head of the creek in the road leading over to Camp branch at an elevation of 1460 feet.

#### Section in Road at Head of Sandlick Creek.

Sandstone	30 ft.
Shale	45 ft.
Coal, Amburgy	3 ft. or more
Covered, perhaps shale	25 ft.
Sandstone	20 ft.

The Whitesburg coal was seen at only one place on Sandlick, where it has its maximum thickness of any location in the county. The opening occurs on the right,  $\frac{3}{4}$  mile up Hurricane branch.

#### Whitesburg Coal.

Shale.  
Cannel slate ..... 3 $\frac{1}{2}$ "  
Hard coal ..... 52 $\frac{1}{2}$ "  
Dark shale.  
Elevation, 1652.

The Whitesburg coal has an area sufficiently large to justify operation on this coal in this region. It is the principal coal used for domestic consumption at Whitesburg.

Underlying a somewhat smaller area than the Whitesburg coal, but excelling it in thickness and in quality, the Fire-clay coal offers an inducement to mining companies worthy of consideration. While it is high in the hills, in many places it has over 450 feet of cover. It is opened in three places on Sandlick creek. The first is on the left,  $\frac{3}{4}$  mile up the first large left branch of the main creek, where the following section was measured by Mr. Straub:

#### Fire-clay Coal.

Shale.	
Coal ..	39"
Flint fire-clay	4"
Coal . . .	18"
Clay	1"
Splint ..	7" +
Clay.	
Elevation, 1580.	

The second opening is  $\frac{1}{2}$  mile up Hurricane branch, on the left.

Fire-clay Coal.	
Sandstone.	
Coal	50"
Flint fire-clay	4 $\frac{1}{2}$ "
Coal	21"
Clay bottom.	
Elevation, 1702.	

The third opening is just south of the road gap between Sandlick and Dry fork, at an elevation of 1690 feet. The bed here shows 25 inches of coal above 8 inches of flint clay and 18 inches below the flint clay.

At Whitesburg the Elkhorn coal is so badly cut up with partings that it is not mined even for local use. It occurs at an elevation of 1260 feet above sea level and 100 feet above the bed of North fork. The following is a section of the strata exposed on Solomon branch just above town, on the left of the river:

Section on Solomon Branch at Whitesburg.

Siliceous sandstone.	
Shale .....	5 ft
Coal ..	30"
Siliceous shale	35 ft.
Coal, Elkhorn only upper bench exposed.	24"
Siliceous shale	40 ft.
Coal .....	30"
Stratified sandstone or shale	20 ft
Black slate	42"
Coal ..	12"
Massive sandstone, quarried at Whitesburg	35 ft
Coal	16"
Black shale	3"
Gray clay shale	24"
Coal ..	3"
Black shale	5 ft.

The massive quarry sandstone, given above, rests unconformably on the 16-inch coal overlying black shale. One-eighth of a mile up Solomon branch it is 25 feet above the bed of the river, while at the quarry just above the bridge at Whitesburg, the bottom of the sandstone is at or below water level.

On the left of the tunnel,  $\frac{1}{2}$  mile above Whitesburg, the following strata are exposed:

Section at Tunnel Above Whitesburg.

Shale .....	10 ft.
Coal, 30 to 40 feet below Elkhorn	26-30"
Shale .....	25 ft.
Coal, thin.	
Shale .....	5 ft.
Sandstone .....	5 ft.
Coal .....	6"
Sandstone, quarry stone below	30 ft
Shale .....	15 ft.
Coal bloom.	
Siliceous shale ..	8 ft
Coal ..	6"
Sandstone	55 ft.
Coal.....	{ Black slate . 18"
	{ Coal ..... 6"
	{ Shale ..... 12"
	{ Coal ..... 12"
	{ Shale . 18"
Massive sandstone to river	35 ft

The Whitesburg coal, which supplies a large part of the fuel used in Whitesburg, is opened on the roadside to Little Cowan creek  $\frac{3}{4}$  mile south of town.

Section at Whitesburg Bank.

Fire-clay coal in road.	
Siliceous slate and sandstone ..	50 ft.
Black slate.	
Coal, Whitesburg	{ Cannel slate 9 10"
	{ Black slate 0 1 $\frac{1}{2}$ "
	{ Coal .. 33" +
Elevation, 1660.	

In a nearby opening:

Black slate.	4"
Cannel coal or slate ..	2 $\frac{1}{2}$ "
Coal ..	1"
Black slate	37 $\frac{1}{2}$ "
Coal	
Clay bottom.	

## CRAFTS COLLY CREEK.

On a left branch of a small left branch, 1 mile up, three coals are exposed with the relation shown in the following section:

## Section 1 Mile up Crafts Colly.

Sandstone.		
Coal, reported		33"
Interval		10 ft.
Coal		24"
Interval, shale (?)		35 ft.
Coal.		24"
Shale.....	Elkhorn, elevation, 1309	4½-5 ft.
Coal		
Interval		55 ft.
Coal, reported		42"

As shown above the Elkhorn is thin and badly disfigured with a thick clay parting. The area of disturbance and unsettled conditions in the formation of this coal comprises an area with Whitesburg as the center and including Cowan, Pert, the lower part of Crafts Colly and Sandlick creeks.

ALLEN BRANCH.—The Elkhorn coal is opened on the right ½ mile up.

## Elkhorn Coal.

Black shale.	
Coal	6½"
Shale	2"
Coal	1½"
Shale	1"
Coal	11"
Shale	2½"
Coal	20½"
Shale.	
Elevation, 1334.	

Two hundred yards up the branch the following section was measured:

## Elkhorn Coal.

Shale.	
Coal	10½"
Clay	2½"
Coal	15½"
Shale	2½"
Coal with splint.	22½"

With an interval of 395 feet above the Elkhorn, the Fire-clay coal near the head of the right fork, is opened with 54 inches of coal. No flint clay was found.

## Section on Allen Branch Below Elkhorn Coal.

Elkhorn coal.	
Sandstone, thin bedded	10 ft.
Shale	30 ft
Sandstone, thin bedded	10 ft
Slate and shale	15 ft
Coal	2 ft.
Siliceous shale	35 ft.
Coal, thin.	
Sandstone	35 ft.

On the right of the first left branch above Allen branch, the Elkhorn coal presents the following section at the mouth of a flooded entry:

## Elkhorn Coal.

Shale.	
Coal	2"
Shale	7"
Coal	1"
Clay	1½"
Coal	13"
Clay	½"
Coal	2"
Shale	14"
Coal	5"
Clay	4-7"
Coal	15"
Shale	3"
Coal	3"
Splint	10"
Coal	2"
Rashy coal	6"
Clay	¼"
Splint	2½"
Shale bottom.	
Elevation, 1370.	

LICKING ROCK BRANCH.—The Elkhorn coal, on the left  $\frac{1}{2}$  mile up, shows the following section:

Elkhorn Coal.	
Shale.	
Coal .....	20"
Clay .....	1½"
Coal .....	27½"
Elevation, 1370.	

RIGHT FORK.—On the right fork of Colly,  $\frac{1}{2}$  mile above Licking Rock branch, the following section was made. The Elkhorn coal in the section is opened 100 yards up a right branch,  $\frac{1}{2}$  mile up, at an elevation of 1330 feet:

Section on Right Fork of Colly.	
Coal, reported .....	36"
Shale .....	30 ft.
Coal, Elkhorn.....	{ Black shale.
	{ Coal .....30"
	{ Clay ..... $\frac{1}{2}$ "
	{ Coal .....37"
	{ Clay bottom.
Shale interval .....	30 ft.
Coal .....	14"
Shaly sandstone .....	45 ft.
Coal, Penny.....	{ Coal .....8"
	{ Clay .....6"
	{ Coal .....10"
	{ Clay bottom.
Sillaceous shale .....	35 ft.
Coal, thin.	
Sandstone.	

The Whitesburg coal is opened on the left, at the head of the right fork.

Whitesburg Coal.	
Sandstone.	
Black slate .....	36"
Bone .....	4½"
Coal .....	34½"
Elevation, 1685.	

At Wilson Sergeant's, on the main creek,  $\frac{3}{4}$  mile below the mouth of Stallards fork, the Elkhorn coal is opened, on the left, at an elevation of 1315 feet, and the Penny coal at creek level.

Section at Wilson Sergeant's.

Shale.		
Coal, reported.....	Coal .....	8"
	Clay .....	1½"
	Coal .....	46½"
Interval ..		45 ft.
Coal, Elkhorn.....	Black slate.	
	Coal .....	26"
	Clay, reported .....	1"
	Coal .....	45"
Interval ..		45 ft.
Shale .....		20 ft.
Coal, Penny.....	Coal ..	10"
	Clay ..	5"
	Coal ..	2½"
	Shale ..	1"
	Coal ..	1½"
	Shale ..	½"
	Coal ..	1½"
	Clay ..	4"
	Coal ..	12½"
	Clay ..	1"
	Coal ..	2½"
	Clay and coal.....	3½"
	Coal ..	4½" +

In the first branch on the left above Mr. Sergeant's, the Elkhorn coal is opened with the following section:

Elkhorn Coal.	
Shale.	
Coal .....	24"
Clay with 1 inch coal..	1 to 8"
Coal .....	9"
Splint .....	5"
Coal .....	17½"
Elevation, 1315.	

The same coal is opened again at the level of the road,  $\frac{1}{4}$  mile up, and has a total thickness of  $66\frac{1}{2}$  inches with  $7\frac{1}{2}$  inches of clay 25 inches from the top.

The Elkhorn coal goes under drainage a few yards above the forks at an elevation of about 1315 feet. About 200 yards above the mouth of Stallards fork, on the latter, the bed section shows the following at the mouth of an open cut:

## Elkhorn Coal.

Shale . . . . .	10 ft.
Black slate . . . . .	2 ft.
Coal . . . . .	28"
Clay with 1 inch coal . . . . .	10"
Coal, in part splint . . . . .	$32\frac{1}{2}$ "

The Amburgy coal is opened on the left of the main creek, 1 mile above the mouth of Stallards fork.

## Amburgy Coal.

Shale . . . . .	
Coal . . . . .	2"
Shale . . . . .	7"
Coal . . . . .	3 to 4"
Shale with 1 inch coal . . . . .	8"
Coal, in water, reported . . . . .	28"
Elevation, 1475.	

STALLARDS FORK.—One mile up, on the left, the Whitesburg coal is opened at an elevation of 1670 feet. Mr. Straub reports 41 inches of coal under black slate roof.

At the head of the right fork of Stallards, at Jim Comb's house, the Fire-clay coal is opened.

## Fire-clay Coal.

Coal . . . . .	29"
Flint clay . . . . .	4"
Coal, reported . . . . .	23"
Elevation, 1700.	

## CRAM CREEK.

The Elkhorn coal is opened on the right of Cram creek,  $\frac{1}{2}$  mile above the forks.

## Elkhorn Coal.

Shale . . . . .	
Coal . . . . .	18"
Shale . . . . .	6"
Coal . . . . .	4"
Clay . . . . .	$10\frac{1}{2}$ "
Coal . . . . .	6"
Clay . . . . .	$5\frac{1}{2}$ "
Coal . . . . .	40"
Clay bottom.	
Elevation, 1450.	

## PINE CREEK.

On the left,  $\frac{1}{2}$  mile up, one of the coals below the Elkhorn is opened at an elevation of about 1280 feet. It is perhaps 150 feet below the Elkhorn coal.

## Section of Coal 150 Feet Below Elkhorn Coal.

Shale . . . . .	
Coal . . . . .	42"

About 200 yards down the creek, at the level of the road, the same coal is opened with the following bed section:

## Section of Coal 150 Feet Below Elkhorn Coal.

Shale . . . . .	
Soft coal . . . . .	$5\frac{1}{2}$ "
Hard coal . . . . .	$1\frac{1}{2}$ "
Splint . . . . .	$1\frac{1}{2}$ "
Hard coal . . . . .	24"
Clay bottom.	

The coal in the entry is dipping S.  $20^{\circ}$  W. at an angle of  $5^{\circ}$ . A massive sandstone comes down close to the coal.

With an interval of 60 feet below, a coal is partially opened on the left,  $\frac{1}{4}$  mile above the mouth of Pine creek.

Section  $\frac{1}{4}$  Mile up Pine Creek.

Coarse sandstone.  
 Shale . . . . . 30 ft.  
 Black shale . . . . . 4 ft.  
 Coal . . . . . 6"  
 Blue clay . . . . . 17"  
 Coal, bottom hidden..12"+

On the right of a left branch  $1\frac{1}{4}$  miles up Pine creek, the Elkhorn coal is opened. Mr. Straub's section of this coal is as follows:

## Elkhorn Coal.

Shale.  
 Coal . . . . . 24"  
 Clay . . . . . 5"  
 Coal . . . . . 11 $\frac{1}{2}$ "  
 Clay bottom.  
 Elevation, 1488.

## BOTTOM FORK.

On the left,  $\frac{1}{2}$  mile up, the Elkhorn coal is opened at an elevation of about 220 feet above the river.

## Elkhorn Coal.

Shale.  
 Coal . . . . . 17"  
 Shale . . . . . 3"  
 Coal . . . . . 17 $\frac{1}{2}$ "  
 Clay . . . . . 13"  
 Coal, bottom hidden..20"+

From here to the head of the creek,  $2\frac{1}{4}$  miles due east on a direct line, the Elkhorn bed rises 41 $\frac{1}{2}$  feet to the mile. The hills on either side are not sufficiently high to catch any of the higher, commercially workable coals, and the coals below the Elkhorn, two of which are workable further east, have not been opened.

Twelve different openings on the Elkhorn coal were visited and measurements taken of all that were opened. It will be seen from the following sections that the coal here will eventually supply a large amount of fuel. The hills rise 300 feet or more above the coal, giving a large

acreage to the north and to the south. The coal as shown in the opening at the head of the creek, at the foot of Pine mountain, is unaffected by the Pine mountain fault.

## Sections of Elkhorn Coal on Bottom Fork.

On right of left branch 1 mile up. Reported by Straub.

Black shale.  
 Coal . . . . . 26"  
 Shale . . . . . 2"  
 Coal . . . . . 14"  
 Clay, knife edge thickness.  
 Coal . . . . . 32"  
 Shale bottom.

On left of left branch  $1\frac{1}{4}$  miles up. Reported by Straub.

Black slate.  
 Coal . . . . . 24"  
 Clay . . . . . 4"  
 Coal . . . . . 38"  
 Shale bottom.

On right of same branch. Reported by Straub.

Shale.  
 Coal . . . . . 24"  
 Shale . . . . . 2 $\frac{1}{2}$ "  
 Coal . . . . . 14"  
 Shale . . . . . 2 $\frac{1}{2}$ "  
 Coal . . . . . 10"  
 Shale bottom.

On the left  $2\frac{1}{4}$  miles up:

Black slate.  
 Coal . . . . . 24 $\frac{1}{2}$ "  
 Shale with 1 inch coal 4 $\frac{1}{2}$ "  
 Coal . . . . . 15"  
 Soft clay . . . . . 29"  
 Coal in part splint 18"  
 Shale bottom.  
 Elevation, 1474.

In places the lower bench increases to 22 inches, the middle decreasing correspondingly.

## At the Head of Bottom Fork, on the Right.

Shale.	
Coal . . . . .	27"
Shale with 1 inch	
coal . . . . .	4-6"
Coal . . . . .	13"
Clay . . . . .	4-6"
Coal . . . . .	9"
Splint . . . . .	7"
Coal . . . . .	8"
Shale bottom.	
Elevation, 1505.	

On the right of North fork,  $\frac{1}{2}$  mile above the mouth of Bottom fork, at W. O. Holbrook's, the following coals were opened by the Swift Coal and Timber Company. The lower coal is 109 feet above the river, making the elevation of the Elkhorn bed about 1425 feet above sea level:

## Section at W. O. Holbrook's.

Coal . . . . .	4"
Clay . . . . .	6 ft.
Coal . . . . .	6"
Interval . . . . .	21 ft.
Cannel coal . . . . .	6"
Interval . . . . .	4 ft.
Coal . . . . .	18"
Interval . . . . .	55 ft.
Coal, Elkhorn. . . . .	Coal . . . . . 15"
	Parting . . . . . 4"
	Coal . . . . . 14"
	Parting . . . . . 19"
	Coal . . . . . 22"
Interval . . . . .	33 ft.
Coal, sandstone roof and bottom. . . . .	16"
Interval . . . . .	25 ft.
Coal . . . . .	16"
Interval . . . . .	67 ft.
Coal . . . . .	2"
Parting . . . . .	14"
Coal . . . . .	20"

## THORNTON CREEK.

On the left of a left branch,  $\frac{1}{4}$  mile up Thornton, the Elkhorn coal is opened showing the following section:

## Elkhorn Coal.

Shale.	
Coal . . . . .	22½"
Clay . . . . .	1"
Coal . . . . .	23½"

Elevation, 1375.

On the right of the creek  $\frac{1}{2}$  mile up:

## Elkhorn Coal.

Shale.	
Coal . . . . .	20¼"
Shale, with 1½	
inches coal . . . . .	2½"
Coal . . . . .	11¾"
Splint . . . . .	6"
Coal . . . . .	15"

Shale bottom.

Elevation, 1405.

WOLFPEN BRANCH.—The Elkhorn coal is opened on the left,  $\frac{1}{2}$  mile up, at an elevation of 1375.

## Section on Wolfpen Branch.

Shale.	
Coal, Elkhorn. . . . .	Coal . . . . . 21"
	Shale . . . . . ½"
	Coal . . . . . 30"
Covered . . . . .	40 ft.
Slaty sandstone . . . . .	15 ft.
Siliceous slate . . . . .	10 ft.
Coal, Penny. . . . .	Coal . . . . . 8"
	Shale . . . . . 1"
	Coal . . . . . 8"
Slaty sandstone . . . . .	8 ft.
Black slate . . . . .	2 ft.
Coal . . . . .	Coal . . . . . 19"
	Clay . . . . . 8"
	Coal . . . . . 1"
	Black shale . . . . . 4"
	Coal . . . . . 4"
Siliceous slate . . . . .	Clay . . . . . 24"
	15 ft.
Coal. . . . .	
Massive sandstone . . . . .	20 ft.
Shale. . . . .	

The Elkhorn coal is opened on the left of the main creek,  $1\frac{1}{2}$  miles up, at an elevation of 1355 feet, with 54 inches of coal at the outcrop.

Section on the Left 2 Miles up Thornton.

Sandstone interbedded with black slate.

Coal, Elkhorn	Coal	28"
	Splint	6½"
	Coal	16½"
Shale		25 ft.
Massive sandstone		5 ft.
Coal		18"
Shale		8 ft.
Sandstone		12 ft.
Shale and sandstone		5 ft.
Coal		15"
Sandstone		10 ft.
Coal, Penny	Coal	12"
	Clay	1"
	Coal	5"
	Clay	5"
	Coal	15½"
Shale		12 ft.
Coal		6"

The Elkhorn coal sinks below drainage on Thornton 3 miles up at an elevation of 1370 feet: Just below, on the right, the following bed section was made:

Elkhorn Coal.

Shale.	
Black slate	24"
Coal	28"
Splint	6½"
Coal	16½"
Shale bottom.	

On the right of the creek opposite where the Elkhorn coal sinks below drainage, the Fire-clay coal is opened.

Fire-clay Coal.

Shale.	
Coal	31½"
Flint clay	4"
Coal	18"+
Elevation, 1772.	

MILLSTONE CREEK.

The Elkhorn coal is opened  $\frac{1}{2}$  mile up the first left branch, at an elevation of 1380 feet, with 66 inches of clean coal under 3 feet of dark shale.

On the right of the second left branch, at the same elevation, a thin knife edge parting comes in  $21\frac{1}{2}$  inches from the top. Two feet of the lower bench is exposed above water.

On the left of the first right branch,  $\frac{3}{4}$  mile up, the same coal gave the following bed section at the mouth of a wet entry:

Elkhorn Coal.

Shale	15 ft.
Black slate	3 ft.
Coal	22"
Rash	1"
Coal	26"
Splint	10"
Coal, 13 inches	
under water	17"

The lower 10 inches is reported cannel coal, large lumps of which were found on the dump.

Section in a Drain 100 Yards Below Last.

Coal bloom on bench.

Sandstone	10 ft.
Covered	30 ft.
Sandstone	20 ft.
Covered	5 ft.
Sandstone, fine grained, micaceous.	40 ft.
Covered	7 ft.
Shale	3 ft.
Sandstone	20 ft.
Covered containing coal bloom	10 ft.
Sandstone, slaty	10 ft.
Sandstone, massive	20 ft.
Drab-blue shale	8 ft.
Covered, place of Elkhorn coal	10 ft.
Thin bedded, micaceous sandstone	20 ft.
Covered, containing coal on opposite hill	15 ft.
Thin bedded sandstone	35 ft.
Coal, thin.	
Shale	35 ft.
Coal	10"
Gray, siliceous shale graduating into sandstone	15 ft.+



## LEFT FORK.

In a partially closed opening on the left,  $\frac{1}{4}$  mile up the left fork, Mr. Straub gives the following bed section at the mouth of the entry:

Elkhorn Coal.	
Sandstone.	
Shale .....	72"
Coal .....	20"
Clay, knife edge thickness.	
Coal, bottom covered .....	24"
Elevation, 1395.	

CANE FORK OF LEFT FORK.—On the right,  $\frac{1}{4}$  mile up, the Elkhorn has the following section:

Elkhorn Coal.	
Shale .....	10 ft.
Black slate .....	2 ft.
Coal .....	22"
Black shale .....	$\frac{1}{2}$ "
Coal .....	27"
Elevation, 1355.	

One-eighth mile above the mouth of Cane fork, Mr. Straub reports 54 inches of clean coal under 5 feet of dark shale, at an elevation of 1384 feet.

The Penny coal is exposed in the bed of the creek 300 yards below the forks, with following section:

Penny Coal.	
Shale.	
Coal .....	9"
Clay .....	2"
Coal to waters edge..	6" or more.
Elevation, 1300.	

The Elkhorn coal sinks below drainage,  $\frac{1}{4}$  mile up the left fork, at an elevation of 1355 feet. In a nearby opening the coal at the mouth of the bank shows 48 inches of clean coal. On the right fork at about the same elevation the coal is 52 inches thick, clean coal.

## MAIN RIGHT FORK OF MILLSTONE.

The Elkhorn coal at the forks is about 125 feet above the bed of the creek or 1395 feet above sea level. The rise in the stream and the northwest dip, carry it below drainage a short distance above the mouth of Meadow fork at an elevation of 1365 feet. The following bed sections indicate a uniform thickness with a slight development near the center of the clay parting which becomes more prominent across on Yonts fork.

## Sections of Elkhorn Coal on Right Fork of Millstone.

On right  $\frac{1}{2}$  mile up Barn branch:

Shale.	
Black slate .....	18"
Coal .....	17"
Sooty clay, knife edge thickness.	
Coal .....	9 $\frac{1}{2}$ "
Splint .....	7 $\frac{1}{2}$ "
Coal .....	15 $\frac{1}{2}$ "
Clay bottom.	
Elevation, 1350.	

On the left of creek,  $\frac{1}{8}$  mile above Barn branch:

Sandstone.	
Black shale .....	48"
Coal to water's edge 26 inches, reported.....	48" Elev. 1360
Covered .....	5 ft.
Sandstone .....	25 ft.
Shale .....	50 ft.
Coal .....	2 ft. +
Shale, weathering to sandstone.	

In the first small drain above Barn branch on the left, the Elkhorn coal has 58 inches clean coal.

On the right of right branch  $\frac{1}{2}$  mile below Lick fork:

Shale .....	60"
Coal .....	19"
Shale .....	$\frac{1}{4}$ "
Coal .....	13 $\frac{1}{4}$ "
Splint .....	3"
Coal .....	21 $\frac{1}{2}$ "
Clay floor.	
Elevation, 1340.	

On the left,  $\frac{1}{4}$  mile above Lick fork:

Dark shale.  
Coal .....29½"  
Splint ..... 3"  
Coal .....16"  
Elevation, 1383.

In the next left drain above, the coal shows:

Black slate . . . .18"  
Clean coal .....48"  
Drab clay bottom. ....12"

On the right of creek,  $\frac{3}{4}$  mile up:

Dark shale ..... 24"  
Clean coal . . . .48"  
Drab clay bottom.  
Elevation, 1360.

One-fourth mile up Meadow fork:

Black slate .....18"  
Clean coal .....49"  
Clay bottom.  
Elevation, 1366.

On the right,  $\frac{1}{2}$  mile up Lick fork:

Black slate .....12"  
Coal .....21"  
Shale ..... 1"  
Coal ..... 9½"  
Splint ..... 7½"  
Coal .....15"  
Elevation, 1360.

At Horn P. O., on the right,  $\frac{3}{4}$  mile up:

Shale . . . . . 60"  
Black slate . . . . 1"  
Coal . . . . . 8"  
Splint ..... 8½"  
Coal ..... 7½"  
Splint . . . . . 2"  
Coal . . . . . 5½"  
Clay bottom.  
Elevation, 1375.

The Elkhorn coal goes under drainage on Lick fork 9-10 of a mile up, at an elevation of 1400 feet.

The only other coal of importance on the main Right fork of Millstone is the Fire clay coal which is opened on the left of Meadow fork,  $\frac{3}{4}$  mile up.

#### Fire-clay Coal.

Crop of rider.  
Sandstone . . . . . 15 ft.  
Shale . . . . . 10 ft.  
Coal . . . . . 1½"  
Dark shale . . . . 14"  
Coal . . . . . 40"  
Flint fire-clay . . . 4½"  
Coal . . . . . 15¼"  
Cannel . . . . . ½"  
Coal . . . . . 4"  
Shale . . . . . 2½"  
Splint . . . . . 1"  
Coal . . . . . 2"  
Splint . . . . . 2½"  
Coal . . . . . 2"  
Clay bottom.  
Elevation, 1760.

#### NORTH FORK ABOVE BOONE FORK.

The Elkhorn coal on the right side of North fork up to Laurel fork, is undisturbed by the Pine mountain uplift. A small area of good coal also occurs between Laurel fork and Buck branch. The southern extension of the coal is limited and will be found broken and difficult to recover. On the north side of North fork the coal is intact to Payne gap. It disappears below drainage  $\frac{3}{4}$  mile below the gap at an elevation of 1595 feet.

On the left of the river,  $\frac{1}{2}$  mile above the mouth of Boone fork, the coal is opened at an elevation of 1455 feet.

#### Section of Elkhorn Coal and Hill Below.

Shale, dark at base .....	24"
Coal.....	21½"
Shale, rash.....	1"
Coal, bottom covered.....	21"
Sandstone .....	35 ft.
Covered .....	18 ft.
Sandstone, covered in part.....	67 ft.
Covered .....	5 ft.
Shale and sandstone .....	10 ft.
Sandstone .....	35 ft.
Covered, shale (?) .....	30 ft.
Coal.	

In the bed of the river,  $\frac{1}{4}$  mile above the mouth of Laurel branch, on the left, the Shelby gap coal is opened 243 feet below the Elkhorn bed.

**Shelby Gap Coal.**

Sandstone . . . . .	5 ft.
Coal . . . . .	4½"
Shale rash . . . . .	½"
Coal . . . . .	4"
Black shale . . . . .	1½"
Coal . . . . .	10"
Hard clay.	
Elevation, 1307.	

**RITTER BRANCH.**

The Elkhorn coal is opened near the head, on the right.

**Elkhorn Coal.**

Coal . . . . .	30"
Shale parting . . . . .	6"
Coal . . . . .	36"
Elevation, 1586.	

**LAUREL FORK.**

The Elkhorn coal is opened on the right, 1 mile up.

**Elkhorn Coal.**

Shaly sandstone . . . . .	10 ft.
Black shale . . . . .	24"
Coal . . . . .	26"
Clay parting . . . . .	2"
Coal . . . . .	38"
Clay bottom.	
Elevation, 1567.	

**HOLBROOK BRANCH.**

On the right of the first left fork,  $\frac{1}{4}$  mile up, the Elkhorn coal is opened near the foot of Pine mountain.

**Elkhorn Coal.**

Sandstone . . . . .	6 ft.
Coal . . . . .	20"
Clay . . . . .	4"
Coal . . . . .	35"
Clay . . . . .	20"
Coal, slickensided . . . . .	32"
Elevation, 1596.	

Opposite the mouth of Holbrook branch, on the left of the river, the coal is opened as follows:

**Elkhorn Coal.**

Coal . . . . .	21"
Shale . . . . .	8"
Coal . . . . .	31"
Shale or clay . . . . .	7"
Coal . . . . .	33"
Elevation, 1611.	

**FISHPOND BRANCH.**

Two openings near the head, on the right, show the following bed sections:

**Elkhorn Coal.**

(1)	(2)
Coal . . . . .	51"
Shale . . . . .	12"
Coal . . . . .	48"
Elevation, 1582.	
Coal . . . . .	48"
Shale . . . . .	6"
Coal . . . . .	49"

**BUCK BRANCH.**

The coal is opened  $\frac{1}{4}$  mile up the right fork. The coal shows diagonal cleavage due to proximity to Pine mountain fault.

**Elkhorn Coal.**

Shale.	
Coal . . . . .	18"
Clay . . . . .	½"
Coal . . . . .	42"
Elevation, 1596.	

On the left of North fork near where the Elkhorn coal goes under drainage, it has developed a thick shale parting as shown in the bed section below.

**Elkhorn Coal.**

Coal . . . . .	51"
Clay . . . . .	19"
Shale . . . . .	69"
Coal . . . . .	50"
Elevation, 1591.	

At a point 1400 feet to the northeast, Bore record No. 4 of the Consolidation Coal Company is as follows:

Bore Record No. 4.	
Surface .....	1843
Coal .....	1750
Coal .....	1689
Coal .....	1674
Elkhorn coal at.....	1605
Coal .	1568
Coal .	1536
Coal .	1478
Coal .	1470
Coal, Shelby Gap .	1376

#### BOONE FORK.

On the right,  $\frac{1}{4}$  mile up, the Elkhorn Coal Company is operating the Elkhorn coal at Kona. The elevation of the coal is about 225 feet above the river. The following is an average section in the mine:

Elkhorn Coal at Kona.	
Shale.	
Coal . . . . .	21"
Shale rash . . .	1"
Coal .. . . .	11 $\frac{1}{2}$ "
Splint . . . . .	2"
Coal . . . . .	12 $\frac{1}{2}$ "
Splint . . . . .	2"
Coal, soft . . . .	9"
Clay floor.	
Elevation, 1460.	

At Seco, 1 mile above Kona, the Southeast Coal Company at the time of the writer's visit to the place, had near completion a large plant to operate the Elkhorn coal.\* The two mines that are to be operated at present are located, one on the left of the large branch that enters Boone fork at Seco, and the other on the right of the first left drain of the branch. Following are sections of the coal in the two mines:

\*Now in operation.

#### Elkhorn Coal at Seco.

Mine No. 1.	Mine No. 2.
Shale.	Shale.
Coal .....19"	Coal .. 20 $\frac{1}{2}$ "
Rash and clay ..... 1"	Rashy shale . 1 $\frac{1}{2}$ "
Coal .....10"	Coal . 10"
Splint ..... 3"	Splint 2"
Coal .....11 $\frac{1}{2}$ "	Coal . 22 $\frac{1}{4}$ "
Splint ..... 1 $\frac{1}{2}$ "	Clay bottom.
Coal ..... 5 $\frac{1}{2}$ "	Elevation, 1373.
Clay bottom.	
Elevation, 1362	

#### Analysis of Elkhorn Coal from Mine No. 1.

Laboratory No. G-3729, Elkhorn coal, Mine No. 1, Southeast Coal Co., Seco, Ky. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.23	2.11
Volatile combustible matter .....	38.17	37.83
Fixed carbon .....	57.47	56.96
Ash .....	3.13	3.10
Total .....	100.00	100.00
Sulphur .....	1.70	1.68
B. T. U. per pound.....	13,820.00	13,700.00
Specific gravity ..	1.282	
Moisture lost by air drying . . . . .		0.89

Twenty-five feet above the mouth of the mine where section No. 1 was obtained, the Elkhorn rider is reported 42 inches thick. In excavating for the foundation of the boiler house a coal 20 inches thick was exposed. The interval from this coal up to the Elkhorn coal is 120 feet.

#### POTTER FORK.

Mines Nos. 303 and 304 of the Elkhorn Mining Company are located on the right of Potter fork, the former 1 mile and the latter  $1\frac{3}{4}$  miles from the mouth, with following bed section of the coal:

## Elkhorn Coal on Potter Fork.

Mine No. 303, at a point 500 feet in.

Shale roof.		
1. Coal	4"	
2. Clay	6"	
3. Coal	29½"	
4. Clay	2¾"	
5. Coal	10"	
6. Splint	8"	
7. Coal	12"	
8. Splint	1¾"	
9. Coal	10¾"	
10. Clay floor.		

Elevation of mouth, 1521.

## Analysis of Above Excluding Nos. 1, 2, 4, and 10.

Laboratory No. G-3727, Elkhorn coal, Mine No. 303, Elkhorn Mining Company, Fleming, Ky. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture	1.42	2.54
Volatile combustible matter	36.87	36.45
Fixed carbon	58.81	58.14
Ash	2.90	2.87
Total	100.00	100.00
Sulphur	0.66	0.65
B. T. U. per pound	14,030.00	13,870.00
Specific gravity	1.278	
Moisture lost by air drying		1.14

Mine No. 304 at a point 1200 feet in.

1. Shale.	
2. Coal	18½"
3. Clay, knife edge thickness.	29"
4. Coal	4"
5. Clay	11"
6. Coal	7½"
7. Splint	10"
8. Coal	2"
9. Splint	10½"
10. Coal	
11. Clay floor.	

Elevation, 1523.

## Analysis, Excluding Nos. 1, 5 and 11.

Laboratory No. G-3728, Elkhorn coal, Mine No. 304, Elkhorn Mining Company, Fleming, Ky. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture	1.52	2.59
Volatile combustible matter	35.85	35.46
Fixed carbon	59.91	59.26
Ash	2.72	2.69
Total	100.00	100.00
Sulphur	0.71	0.70
B. T. U. per pound	13,910.00	13,760.00
Specific gravity	1.278	
Moisture lost by air drying		1.09

Following are additional bed sections of the Elkhorn coal in this section:

On the left, opposite Mine No. 304:

Coal	24"
Shale	5"
Coal	45"
Elevation, 1535.	

On the right, 2000 feet above Grays branch:

Coal	45"
Shale	4"
Coal	57"
Elevation, 1598.	

On the left, just below Potter Gap:

Coal	36"
Shale	30"
Coal	41"
Elevation, 1621.	

Bore hole No. 9, 2700 feet north of Potters Gap:

Elevation of surface	1881
Interval	75 ft.
Coal, Amburgy	1806
Interval	57 ft.
Coal	1749
Interval	88 ft.
Coal	1661
Interval	61 ft.
Coal, Elkhorn	1600
Coal	36"
Shale	40"
Coal	45"

## BOONE FORK.

## Sections of Elkhorn coal on Boone fork:

On the left,  $\frac{1}{2}$  mile above mouth of Potter fork:

Coal .....24"  
 Shale ..... 2"  
 Coal .....43"  
 Elevation, 1439.

On the left,  $\frac{3}{4}$  mile above mouth of Potter fork:

62 inches clean coal.  
 Elevation, 1436.

On the right, opposite mouth of Wrights fork:

Coal .....24"  
 Shale ..... 1"  
 Coal .....38"  
 Elevation, 1459.

On the left, 1200 feet above mouth of Wrights fork:

Coal . . . . .39"  
 Shale . . . . . 2"  
 Coal . . . . . 19"  
 Elevation, 1443.

LITTLE CREEK.—On the left, 1700 feet up, the Elkhorn bed gives 64 inches of clean coal. In two openings on the right a few feet below where the coal disappears below drainage, at an elevation of about 1375 feet, the coal is 48 inches clean coal.

On the left, 1 mile up, the Whitesburg coal is opened with following bed section:

## Whitesburg Coal.

Black shale.  
 Soft coal . . . . . 10"  
 Hard coal . . . . . 25"  
 Shale, bone and coal.12"  
 Splint . . . . . 5"  
 Shale bottom.  
 Elevation, 1740.

Section from gap to Millstone creek, down to Little creek. Elevation at gap, 1631.

Shale ..... 20 ft.  
 Covered, shale (?) . . . . . 35 ft  
 Coal bloom.  
 Sandstone . . . . . 15 ft  
 Shale . . . . . 10 ft.  
 Coal bloom.  
 Sandy shale . . . . . 13 ft.  
 Massive sandstone . . . . . 12 ft.  
 Shaly sandstone . . . . . 18 ft.  
 Shale . . . . . 2 ft.  
 Coal crop.  
 Shale . . . . . 5 ft.  
 Sandstone . . . . . 22 ft.  
 Shale . . . . . 22 ft.  
 Coal (?)  
 Sandstone, shaly . . . . . 18 ft.  
 Sandstone, massive . . . . . 25 ft.  
 Covered, perhaps sandstone . . . . . 10 ft.  
 Shale . . . . . 2 ft.  
 Elkhorn rider . . . . . 1½ ft.  
 Shale . . . . . 30 ft.  
 Elkhorn coal. Elevation, 1375.  
 Sandstone . . . . . 20 ft.+  
 Blue shale . . . . . 10 ft.  
 Coal . . . . . 8"-10"  
 Blue shale . . . . . 7 ft.  
 Shale . . . . . 40 ft.  
 Sandstone . . . . . 30 ft.  
 Coal.

On the right of Yonts fork, 1400 feet above the mouth of Little creek, the Elkhorn coal is opened as follows:

## Elkhorn Coal.

Coal . . . . . 33"  
 Shale . . . . . 1"  
 Coal . . . . . 36"  
 Elevation, 1424.

QUILLEN FORK.—The Elkhorn coal sinks below drainage at a point 1400 feet up, at an elevation of 1397 feet. The rider occurs 25 feet higher under a massive sandstone.

Section.	
Massive sandstone.	
Coal . . . . .	14-16"
Black shale . . . . .	0-1½"
Coal . . . . .	3"
Black shale.	
Covered interval . . . . .	25 ft.
Elkhorn coal.	

} Elkhorn rider.

On the left of the left fork of Quillen, ½ mile up, Mr. Straub found the Amburgy coal opened as follows:

Amburgy Coal.	
Shale.	
Coal . . . . .	2"
Shale . . . . .	84"
Coal, with 3-inch parting, reported . . . . .	48"
Elevation, 1557.	

On the same hillside, 225 feet higher, at an old opening with fragments of flint fire-clay on the dump, he gives the following section:

Fire-clay Coal.	
Soil.	
Clay . . . . .	1"
Coal . . . . .	4"
Clay . . . . .	2½"
Coal . . . . .	3"
Clay . . . . .	10"
Coal . . . . .	1"
Clay . . . . .	12"
Coal with flint clay parting, reported . . . . .	51½"
Elevation, 1782.	

The town of Hemp Hill is built at the mouth of Quillen fork. Mines Nos. 305 and 306 are located, the former on the right and the latter on the left of Yonts fork, ¼ mile above the mouth of Quillen fork. At the time of the writer's visit the mines had not started operation. Measurement of the coal at the mouth of Mine No.

305 gave the following bed section. Elevation of coal at mouth of the mine is 1406 while that of No. 306 just across the stream is 1408:

#### Elkhorn Coal at Mine 305.

Shale roof.	
Coal . . . . .	22¼"
Clay parting . . . . .	1¾"
Coal . . . . .	38½"
Shale floor.	

The coal sinks below drainage 100 yards above the mouth of the mines.

Opposite the mouth of Quillen fork and continuing for some distance below the tipple at Hemp Hill, the following is a section of the strata below the Elkhorn coal:

#### Section at Hemp Hill.

Elkhorn coal.	
Shale . . . . .	18"
Sandstone . . . . .	20 ft.
Shale, with iron concretions . . . . .	15"
Coal, with two thin partings . . . . .	18"
Clay . . . . .	17"
Siliceous slate . . . . .	30 ft.
Sandstone . . . . .	40 ft.
Coal . . . . .	2-3"
Clay shale . . . . .	2"
Coal . . . . .	16"
Clay . . . . .	24"
Sandstone.	

WOLFPEN BRANCH.—At the head of Wolfpen branch two bore holes were put down by the Consolidation Coal Company. No. 11 was begun at an elevation of 1681 feet and No. 12 at 1970 feet. These holes only show the elevations at which coals were encountered but at depths ranging from 214 to 221 feet below the Elkhorn, a coal was penetrated which probably corresponds to the Shelby Gap coal on Elkhorn creek with a slight thinning of the measures to the northwest.

## Record of Bore Holes.

No. 11.	No. 12.
Surface .....1681	Surface ..... 1970
Interval .....293 ft.	Interval ..... 364 ft.
Elkhorn coal .....1388	Coal .. 1606
Interval . . . 19 ft.	Interval . . . 34 ft
Coal . . . 1369	Amburgy coal .. 1572
Interval . . . 61 ft.	Interval .. 195 ft.
Coal . . . 1308	Elkhorn coal . 1377
Interval .....115 ft.	Interval .. 19 ft.
Coal . . . 1193	Coal .... 1358
Interval . . . 19 ft.	Interval . . . 63 ft
Shelby Gap coal 1174	Coal . . . 1295
	Interval . . . 139 ft.
	Coal . . . 1156

## WRIGHTS FORK.

Numerous openings have been made on the Elkhorn coal, including mines Nos. 301, 302, and 307 of the Elkhorn Mining Corporation in the region of Fleming, and mines Nos. 210, 211, 212, 213, 214, and 215 of the Consolidation Coal Company, in the region of McRoberts. The sections here given are those made by the Consolidation Coal Company followed by individual bed sections of the different mines made by the writer and Mr. Straub.

## Elkhorn Coal on Wrights Fork.

On the left, 1000 feet above Boone fork:	
Coal .....	24"
Clay .....	1"
Coal .....	37"
Elevation, 1470.	
In third left drain below Bottom fork:	
Coal ..	24"
Clay . . . . .	2"
Coal . . . . .	36"
Elevation, 1481.	
On opposite side of Wrights fork:	
Coal . . . . .	18"
Clay . . . . .	1"
Coal . . . . .	37"
Elevation, 1495.	

## On right, opposite mouth of Bottom fork:

Coal .....	30"
Clay .....	3"
Coal . . . . .	39"
Elevation, 1510.	

## At head of Bottom fork:

Coal .....	27"
Clay .....	3"
Coal .....	35"
Elevation, 1471.	

## On the left, in first drain above Bottom fork:

Coal . . . . .	53"
Clay . . . . .	3"
Coal . . . . .	45"
Elevation, 1499.	

## On the right, 1700 feet above Bottom fork:

Coal .....	12"
Clay .....	1"
Coal .....	38"
Elevation, 1514.	

## On the left, 2500 feet above Bottom fork:

Coal .....	50"
Clay . . . . .	3"
Coal . . . . .	41"
Elevation, 1515.	

## On the right, 1500 feet below She fork:

Coal . . . . .	6"
Clay . . . . .	2"
Coal . . . . .	48"
Elevation, 1502.	

## On the right of She fork, 1000 feet up:

Coal . . . . .	27"
Clay . . . . .	2"
Coal . . . . .	36"
Elevation, 1500.	

## On the right of She fork, 3500 feet up:

Coal . . . . .	44"
Clay . . . . .	2"
Coal . . . . .	30"
Elevation, 1474.	



On the right of Wrights fork, just below Chopping branch:

Coal	50"
Clay	2"
Coal	41"
Elevation, 1521.	

On the left, 1000 feet below Tom Biggs branch:

Coal	43"
Clay	2"
Coal	33"
Elevation, 1500.	

On the opposite side of stream:

Coal	36"
Clay	2"
Coal	36"

On the right of Tom Biggs branch, 1900 feet up:

Coal	46"
Clay	2½"
Coal	45"
Elevation, 1519.	

On main fork, 1200 feet below Bark Camp branch, where the coal sinks below drainage:

Coal	44"
Clay	3"
Coal	45"
Elevation, 1500.	

In Bore Hole No. 10 at head of Bark Camp branch:

Coal	73"
Clay	8"
Coal	5"
Elevation, 1530.	

The mining town of Fleming, which is owned by the Elkhorn Mining Corporation, is built along Wrights fork from the mouth of Boone fork to Bottom fork. At present writing, seven mines are opened and operated by this corporation. These are Nos. 301, 302, and 307 on Wrights fork, Nos. 303 and 304 on Potter fork at Haymond, and Nos. 305 and 306 on Boone fork at Hemp Hill.

Mine No. 301 is located on the right of Wrights fork, opposite the mouth of Bottom fork. Mine No. 307 is practically a continuation of 301, the coal from the former

being taken through the gap which separates them and then through the latter and dumped at tippie 301. The elevation of the coal at the mouth of No. 301 is 1510 feet and 1479 feet at the mouth of No. 307.

At the mouth of Mine 301 there are three benches of coal separated by two bands of clay 2 inches each in thickness. The upper bench, which is 12 to 18 inches thick, is left as a roof in mining. The parting which separates the upper from the middle bench at the mouth of the mine, is 2 inches thick and gradually thickens until at the place where the main haulage way emerges from the hill, at the divide separating No. 301 from 307, the parting has increased to 5 feet 2 inches, with two bands of coal in the parting. The upper one, 4 to 6 inches in thickness, unites with the main upper bench. The interval between the upper and middle benches at the mouth of No. 307 mine, which is 1000 feet from the exit of No. 301 mine, has increased to 32 feet and there becomes the Elkhorn rider, which is a characteristic feature to the northwest, as far as the Elkhorn coal is above drainage.

The difference in elevations of the mouths of the two mines, as shown above, is 31 feet, which is within 1 foot of the difference between the main body of the Elkhorn bed and the rider at the mouth of mine 307. That is, the rider from mine 301 to 307 has remained about level, the lower or main bed of the Elkhorn separating from it by a sharp dip. Throughout most of the district where the Elkhorn coal is best developed it generally contains only one parting. It seems probable, therefore, that where there are two partings and a thickening of the bed, it is due to the lower or main bed uniting with the rider as is the case in mine No. 301 at Fleming.

#### Section in Mine No. 307.

At a point 1000 feet in on main:

Shale.	
Coal	22"
Shale	1¾"
Coal	40"
Clay bottom.	

In local depressions in the vein is a bed of cannel coal which has its maximum thickness in the bottom of the

troughs and gradually thins up the sides of the depressions and disappears entirely on the upper flanks and crests of the rolls. In one of these troughs the following bed section was measured:

## Section in Mine No. 307.

Shale.	
Coal .....	26½"
Clay parting ..	2"
Coal ..	48½"
Cannel coal ..	12"
Clay bottom.	

**BOTTOM FORK OF WRIGHTS FORK.**—Mine No. 302 is located ¼ mile up, on the left of Bottom fork. The elevation of the coal at drift mouth is 1407 (?) feet with a northwest dip of 40 feet from the mouth of No. 301.

## Section in Mine 302.

Shale.	
Coal .....	23"
Rash and clay. ....	3"
Coal .....	9"
Splint ..	10"
Coal ..	11¼"
Splint ..	1¾"
Coal ..	4"
Clay.	

## Analysis from Mine 302.

Laboratory No. G-3726, Elkhorn coal, Mine No. 302, Elkhorn Mining Company, Fleming, Ky. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.52	2.26
Volatile combustible matter .....	36.59	36.32
Fixed carbon .....	58.95	58.51
Ash ..	2.94	2.91
Total ..	100.00	100.00
Sulphur ..	0.82	0.81
B. T. U. per pound.....	14,380.00	14,270.00
Specific gravity .....	1.292	
Moisture lost by air drying ..		0.75

## Section of Strata on Bottom Fork.

Sandstone .....	20 ft.
Coal, Elkhorn rider .....	18"
Shale .....	22 ft.
Elkhorn coal.	
Clay .....	24"
Siliceous sandstone .....	23 ft.
Black slate .....	5 ft.
Coal, with 1 inch cannel on top .....	9"
Sandstone and shale .....	30 ft.
Shale .....	8 ft.
Sandstone .....	5 ft.
Shale .....	5 ft.
Coal.....	1½"
Shale, thin.	
Coal .....	19"
Clay ..	12"
Sandstone .....	30 ft.
Coal (?)	
Sandstone ..	15 ft.

**SHE FORK.**—Mines Nos. 210, 211 and 212 of the Consolidation Coal Company, are located ½ mile up She fork. The three mines are located within a short distance of each other and dump the coal over one tipple. The elevation of the coal at pit mouth of mine 211 is 1479 feet.

## Section in Mine No. 211.

Shale.	
Coal .....	21"
Shale parting .....	17"
Coal .....	30"
Shale .....	8"
Coal .....	10½"
Splint .....	10½"
Coal .....	10¼"
Splint .....	2"
Coal .....	7"

The above section was made at the face of main entry, 1500 feet from the pit mouth. As shown in the above section the upper bench is separated from the middle bench by 17 inches of shale. This parting gradually thins toward the pit mouth where it is only a separation without any binder, the upper bench forming a part of the main seam. On Bottom fork, just through the

hill to the southwest, the upper bench is 20 feet above the main coal. The conditions here are similar to those in mines No. 301 and 307 at Fleming.

On the second left, off main entry, 500 feet in, a bed section with sample for analysis were obtained by Mr. Straub.

#### Section in Mine No. 211.

Coal, left as roof.	18"
Clay	8½"
Coal	25"
Parting, knife edge thickness.	
Coal	8"
Splint	11½"
Coal	3"
Splint	4"
Coal	6"
Shale floor.	

#### Analysis of Coal from Mine No. 211.

Laboratory No. G-3725, Elkhorn coal, Mine No. 211, Consolidation Coal Co., McRoberts, Ky. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture	1.49	2.10
Volatile combustible matter	36.15	35.93
Fixed carbon	59.57	59.20
Ash	2.79	2.77
Total	100.00	100.00
Sulphur	0.76	0.76
B. T. U. per pound	14,600.00	13,510.00
Specific gravity	1.284	
Moisture lost by air drying		0.62

#### Section in Mine No. 210.

Coal	44"
Clay	3¼"
Coal	10"
Splint	5"
Coal	3"
Splint	4"
Coal	9"
Splint	1½"
Coal	7"

#### Analysis of Coal from Mine No. 210.

Laboratory No. G-3724, Elkhorn coal, Mine No. 210, Consolidation Coal Co., McRoberts, Ky. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture	1.43	2.22
Volatile combustible matter	35.68	35.40
Fixed carbon	59.85	59.37
Ash	3.04	3.01
Total	100.00	100.00
Sulphur	0.73	0.72
B. T. U. per pound	14,510.00	14,390.00
Specific gravity	1.288	
Moisture lost by air drying		0.80

On the right of a right drain, ½ mile up the left fork of She fork, the Fire-clay coal is opened.

#### Fire-clay Coal.

Shale.	
Coal	37½"
Flint fire-clay	5"
Coal, covered.	
Elevation, 1840.	

Mine No. 213 is located on the right of Wrights fork, just below Chopping branch. The elevation of the bottom of the coal is 1521 feet. The general dip in the mine is ½ per cent. to the northwest, but local bumps and depressions increase the dip in places to as much as 14 per cent.

#### Section in Mine No. 213.

Coal containing mother coal in irregular lenses	44½"
Clay, which varies from 2 to 39 inches	3½"
Coal	8"
Splint	11"
Coal	13½"
Clay floor.	

#### Section Below the Mine.

Sandstone	25 ft.
Siliceous slate	6 ft.
Coal	27½"
Slate	16 ft.
Coal.	15 ft.
Shale	
Place of coal.	63 ft.
Sandstone	24"
Coal	

Mine No. 214 is located on Tom Biggs branch, just below where the coal sinks below drainage. The elevation of the bottom of the coal at the pit mouth is 1515 feet.

Section of Coal in Mine No. 214.

Shale roof.	
Coal .....	40"
Shale .....	1"
Coal .....	43"
Clay bottom.	

Mine No. 215 is located on the left of the main fork, 1000 feet below the mouth of Bark Camp branch, where the coal sinks below drainage. The elevation of the bottom of the coal at pit mouth is 1486 feet. The mine was closed at the time of the writer's visit and no section of the bed was obtained.

On the left of the main stream,  $\frac{3}{4}$  mile above Bark Camp branch, the Amburgy bed is opened for local use.

Amburgy Coal.

Shale.	
Coal .....	11"
Shale rash .....	1"
Hard coal, bottom covered .....	18"+
Elevation, 1636.	

On the new road from the mouth of Tom Biggs branch, on Wrights fork, to the gap leading to Jenkins, the following section was made:

Section from the Gap Between McRoberts and Jenkins to McRoberts.

Elevation of gap, 2067.	
Sandstone, below gap .....	15 ft.
Shale .....	10 ft.
Hamlin coal .....	36"
Clay .....	6"
Sandstone .....	25 ft.
Coal stain of Fire-clay rider.	
Sandstone and shale .....	20 ft.
Shale .....	5 ft.
Fire-clay coal .....	5 ft.
Clay .....	4"
Sandstone .....	12 ft.
Shale .....	12 ft.

Sandstone .....	16 ft.
Shale .....	10 ft.
Whitesburg coal .....	33"
Clay .....	13"
Sandstone .....	30 ft.
Coal .....	6"
Clay .....	2"
Siliceous shale .....	40"
Coal .....	3"
Sandstone .....	3 ft.
Siliceous shale .....	15 ft.
Coal stain.	
Sandstone, hard .....	15 ft.
Covered .....	10 ft.
Sandstone .....	35 ft.
Covered .....	5 ft.
Sandstone .....	10 ft.
Shale .....	45 ft.
Coal (?) .....	
Sandstone .....	40 ft.
Coal, Amburgy (?) .....	33"
Sandstone, hard .....	53 ft.
Coal .....	16"
Siliceous shale .....	16"
Sandstone, grading into siliceous shale below ..	26 ft.
Slaty sandstone, grading into siliceous shale below ..	30 ft.
Dark to chocolate shale .....	5 ft.
Coal .....	6"
Clay .....	3"
Siliceous shale on top, covered below ..	25 ft.
Sandstone at top and siliceous shale at bottom ..	15 ft.
Sandstone .....	33 ft.
Shale .....	12 ft.
Elkhorn coal.	
Sandstone, shaly .....	30 ft.
Coal .....	12"
Shale .....	5 ft.
Sandstone .....	18 ft.
Coal .....	28"
Clay .....	24"
Siliceous shale .....	20 ft.
Black slate .....	18"
Coal .....	14"
Sandstone .....	63 ft.
Coal.	

## ELKHORN CREEK OF BIG SANDY RIVER.

The lowest workable coal exposed in Letcher county, north of Pine mountain, is the one which is opened on the right of Elkhorn creek just above the railroad bridge over Elkhorn creek at Shelby Gap (in Pike county), about 75 feet above the bed of the creek, and again, on the right of the same stream, at the mouth of McPeak branch 2 miles above Shelby Gap. It is also opened on the head of Shelby creek just east of the Letcher county line in Pike county, and at Penny Station on the same stream 5 miles above its mouth.

At the above places its characteristic feature is a parting of laminated coal in the upper half of the bed, with harder coal above and below. Generally a thin band of cannel coal occurs at the top.

At McPeak branch, Shelby Gap, on the head of Shelby creek and at Penny Station, the interval up to the Elkhorn coal is 240 to 263 feet. In bore records Nos. 2, 3, 11 and 12 of the Consolidation Coal Company it is doubtless the coal at intervals of 214, 231, 214 and 221 feet respectively, below the Elkhorn bed. It is described in this report as the Shelby Gap coal.

## PANTHER BRANCH.

Panther branch is a small branch on the Pike county side, on the right of Elkhorn creek, 2 miles below Shelby Gap. On the right,  $\frac{1}{4}$  mile up, the Shelby Gap coal is opened. A section of the coal at the mouth of the opening and of the strata extending down to the mouth of the branch is given below.

Section on Panther Branch.		Elevation, 1390
Coal, Shelby Gap..	Cannel coal . . . . .	1"
	Coal . . . . .	24"
	Laminated coal . . . . .	6"
	Coal . . . . .	12"
	Clay . . . . .	1"
	Coal . . . . .	5"
Shale . . . . .		35 ft.
Coal crop.		
Sandstone . . . . .		25 ft.
Shaly sandstone . . . . .		50 ft.

On the right of Elkhorn creek just above Shelby Gap, the Shelby Gap coal is opened and worked for local use.

## Section at Shelby Gap.

Shale . . . . .	20 ft.
Coal . . . . .	18"
Massive, hard sandstone . . . . .	55 ft.
Coal, Shelby Gap..	Cannel coal . . . . . 1½"
	Coal . . . . . 7"
	Laminated coal . . . . . 13"
	Coal . . . . . 16"
	Clay bottom.
Shale . . . . .	15 ft.
Black shale . . . . .	3 ft.
Coal . . . . .	12"
Shale . . . . .	31 ft.
Sandstone . . . . .	10 ft.

A sample of coal was collected from the opening given in the section and, when analyzed, gave the following:

## Analysis of Shelby Gap Coal.

Laboratory No. G-3720, Shelby Gap coal, Shelby Gap. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture . . . . .	1.47	2.06
Volatile combustible matter . . . . .	36.32	36.10
Fixed carbon . . . . .	57.97	57.63
Gray-brown ash . . . . .	4.24	4.21
Total . . . . .	100.00	100.00
Sulphur . . . . .	.69	.69
B. T. U. per pound . . . . .	13,870.00	13,790.00
Specific gravity . . . . .	1.286	
Moisture lost by air drying . . . . .		.60

The Shelby Gap coal on Elkhorn creek sinks below drainage a short distance above the mouth of McPeak branch at an elevation of 1400 feet. An opening on the coal a few feet below the mouth of the branch, on the right of and 5 feet above Elkhorn creek, gave the following:

## Shelby Gap Coal.

Sandstone.	
Coal . . . . .	8"
Laminated coal . . . .	8½"
Coal . . . . .	18"

The following is a section of the strata on McPeak branch between the Elkhorn coal and the Shelby Gap coal:

## Section on McPeak Branch.

Elkhorn coal.	
Sandstone . . . . .	15 ft.
Covered . . . . .	50 ft.
Sandstone . . . . .	30 ft.
Coal.	
Sandstone . . . . .	65 ft.
Shale . . . . .	10 ft.
Sandstone . . . . .	50 ft.
Shelby Gap coal.	

## Continued down Elkhorn creek:

Hard sandstone . . . .	5 ft.
Shale . . . . .	15 ft.
Coal . . . . .	6-10"
Shale . . . . .	18"
Coal . . . . .	10"
Shale . . . . .	3-4 ft.
Sandstone, light gray . . . . .	25 ft.
Shaly sandstone . . .	15 ft.

At Penny station on Shelby creek, Pike county, a coal is being operated which there is 73 feet below the Elkhorn seam. A mine is also being opened in the latter coal which will be operated from the same tippie as that of the lower mine.

The Elkhorn rider at the first opening made was down on the main bed, as shown in No. 1 of the following sections. About 1000 feet to the northeast, the rider has disappeared leaving the main Elkhorn bed as in No. 2 of the section.

## Elkhorn Coal at Penny.

## No. 1.

Coal . . . . .	4"
Clay . . . . .	5"
Coal rider . . . . .	13"
Clay . . . . .	1"
Coal . . . . .	21"
Clay . . . . .	6"
Coal . . . . .	26½"
Clay floor.	

## No. 2.

Coal . . . . .	32"
Clay . . . . .	3"
Coal . . . . .	31"

A section of the strata exposed on the hillside below the Elkhorn coal at Penny is shown below:

## Section at Penny.

## Elkhorn coal. Elevation 1375.

Shale and sandstone . . . . .	73 ft.
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Penny coal . . . . .	Coal . . . . .	2"
	Clay . . . . .	2"
	Coal . . . . .	46½"

Sandstone . . . . .	85 ft.
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Shale . . . . .	25 ft.
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Sandstone . . . . .	40 ft.
---------------------	--------

Covered . . . . .	25 ft.
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Sandstone . . . . .	15 ft.
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## Coal, Shelby Gap.

Covered . . . . .	160 ft.
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Coal, reported . . . . .	28"
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Shale and sandstone . . . . .	100 ft.
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Coal, at tippie height, reported . . . . .	22"
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Honeycomb sandstone . . . . .	40 ft.
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## Section continued ¼ mile up Shelby creek.

Coal . . . . .	Coal . . . . .	19½"
	Clay . . . . .	2"
	Coal . . . . .	5"
	Clay . . . . .	22"

Sandstone . . . . .	20 ft.
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Coal, reported . . . . .	16"
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## Analysis of Penny Coal.

Laboratory No. G-3730, Penny Coal, Pine creek. Average sample.			
Analysis—Per cent.		Air-dried	As received
Moisture	.....	1.66	1.94
Volatile combustible matter	.....	38.83	38.72
Fixed carbon	.....	57.44	57.28
Ash	.....	2.07	2.06
Total	.....	100.00	100.00
Sulphur	.....	0.88	0.88
B. T. U. per pound	.....	14,010.00	13,970.00
Specific gravity	.....	1.261	
Moisture lost by air drying	.....		0.29

## MARSHALL BRANCH.

On the right, 1 mile up the right fork, the Elkhorn coal is opened at an elevation of 1646 feet. It is opened again just 4000 feet due west, on the left fork, at an elevation of 1624 giving 22 feet westward dip in the locality. In the following sections No. 1 is on the right fork, No. 2 on the left fork and No. 3 in bore hole No. 1.

## Sections of Elkhorn Coal on Marshall Branch.

No. 1.		No. 2.	
Coal	.....81"	Coal	.....14"
Clay	.....14"	Shale or clay	.....4"
Coal	.....30"	Coal	.....32"
Elevation, 1646.		Clay	.....9"
		Coal	.....36"
		Elevation, 1624.	

## No. 3.

Section in bore hole No. 1, 1300 feet north of No. 2 Elevation of coal 1623.

Coal	.....24"
Clay	.....6"
Coal	.....31"

At the forks of Marshall branch, a coal which is 210 feet below the Elkhorn, occurs under 12 inches of black slate with 20 feet of shale above. Thirty-five feet lower, with sandstone between, the Shelby Gap coal gives the bed section shown in the general section below:

## Section on Right of Marshall Branch, Below Forks.

Sandstone	.....	35 ft.
Coal, Shelby Gap	Coal	.....10½"
	Laminated coal	.....7"
	Coal	.....19"
	Siliceous clay	.....6"
Hard, siliceous shale	.....	16 ft.
Coal	Coal	.....9½"
	Rash	.....2"
	Coal	.....7"
Sandstone	.....	25 ft. +
Coal	.....	8"

## McPEAK BRANCH.

Between Marshall and McPeak branches, near the mouths of these streams, there is a well defined dome in which the Elkhorn coal dips in all directions at the rate of 40 feet in the first 1300 feet. North of the dome the dip suddenly flattens out in the normal northwest direction.

The Elkhorn coal is opened on the right, ¾ mile up McPeak branch.

## Elkhorn Coal.

Shale.	
Black slate	.....2"
Coal	.....35"
Clay	.....6½"
Coal	.....52½"
Clay bottom.	
Elevation, 1641.	

A section of the strata exposed on McPeak branch was given under the discussion of the Shelby Gap coal.

From a short distance above the mouth of McPeak branch to the head of Elkhorn creek, the Consolidation Coal Company is operating 8 mines numbered from 201 to 208 inclusive. These, with mines 210 to 215 inclusive on the North fork waters, are operated by the same company with general headquarters at Jenkins. The power plant for operating all the mines and the 7 mines of the Elkhorn Mining Corporation at Fleming, is also located at Jenkins.

MINE No. 201.—This mine is planned to recover the coal between McPeak and Bens branches. The pit mouth is located on the right of Elkhorn creek, half way between the two branches mentioned. The elevation of the bottom of the coal at the mouth is 1574 feet. A section, which is an average one for the mine, was made on the first west haulage 800 feet in, where a sample of coal was collected for analysis.

Section in Mine No. 201.

Shale roof.	
Black slate .....	6"
Top bench .....	39"
Clay .....	6"
Coal .....	9"
Splint .....	14"
Coal .....	19"
Clay bottom.	

The clay parting in the mine varies from 0 to 32 inches. The variation in the thickness of the parting is attended with a corresponding thinning and thickening of the coal. In places the upper bench varies, while in another part of the mine the lower bench is the one to show the variation. In a few localities the parting may thicken to 4½ feet, but may not extend over a distance of 4 to 10 feet. These holes appear to be cut out of the lower bench and filled in with clay.

Locally as much as 2 inches of rash, high in ash, occurs at the bottom of the lower bench. From 1 to 2½ inches of rash occurs at the bottom of the upper bench and is constant throughout the mine.

In this mine the clay parting is very soft throughout the mine and can be cut with a machine. The upper band of rash seems to accompany the soft clay parting. In some of the other mines the clay parting is so hard that it is necessary to make the cutting in the coal just below the parting.

Analysis of Coal from Mine No. 201.

Laboratory No. G-3716, Elkhorn coal, No. 201 mine, Jenkins. Average sample.

Analysis—per cent.	Air-dried	As received
Moisture .....	1.19	1.80
Volatile combustible matter .....	38.53	38.29
Fixed carbon .....	57.87	57.52
Brown ash .....	2.41	2.39
Total .....	100.00	100.00
Sulphur .....	.55	.55
B. T. U. per pound .....	14,680.00	14,590.00
Specific gravity .....	1.290	
Moisture lost by air drying.....		.62

A coal outcrops at No. 201 tippie at an elevation of about 1442, or 132 feet below the Elkhorn coal. It underlies a sandstone 65 feet thick with a massive sandstone below. The coal here is 24 inches in thickness.

MINE No. 202.—This mine is located on the left of Bens branch 2100 feet up. Elevation of pit mouth 1597. The mine was closed at the time of the writer's visit, but the following section of the coal was obtained on No. 1 west, 450 feet in from the pit mouth.

Section in Mine No. 202.

Shale.	
White clay .....	½"
Black slate .....	2"
Coal .....	41"
Rash .....	½"
Soft shale .....	8"
Coal .....	39½"
Clay bottom.	

MINE No. 203.—This mine is located on the left of Joe's branch, about 1500 feet up. The elevation of the bottom of the coal at the mouth is 1615 feet. The clay parting in this mine varies less than at No. 201, the minimum being 0 and the maximum 12 inches, with an average of 8 inches. The thin rash at the bottom of the upper and lower benches is present in this mine. Where the coal is thick, as it is in most of the mines, from 10 to 15 inches of coal is left as roof, but in No. 203 no coal can be left as roof owing to the thinning of the coal here. Where the



coal is all taken down bad roof conditions exist and more timbering is necessary.

In some parts of the mine a slight disturbance of the coal occurs in the lower bench, where the coal is slickensided and rolled into small troughs and ridges. This, however, does not affect the quality of the coal.

#### Sections in Mine No. 203.

On the main track, 500 feet in:

Shale.	
Black slate .....	1½"
Coal .....	41½"
Parting .....	¾"
Coal .....	41½"
Clay bottom.	

In room 11, third right, off main:

Coal, not all seen....	35"
Clay parting .....	5"
Coal .....	72"
Clay bottom.	

At mouth of 1st west, off main, 750 feet from pit mouth:

Shale.	
Coal .....	42"
Clay .....	4"
Hard coal .....	8"
Splint ..	13"
Hard coal . ....	16½"

A sample of coal from the last place was taken for analysis

#### Analysis of Coal from Mine No. 203.

Laboratory No. G-3717, Elkhorn coal, No. 203 mine, Jenkins. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.22	2.43
Volatile combustible matter .....	35.86	35.42
Fixed carbon .....	59.96	59.23
Brown ash .....	2.96	2.92
Total .....	100.00	100.00
Sulphur .....	.62	.61
B. T. U. per pound ..	14,520.00	14,340.00
Specific gravity ..	1.284	
Moisture lost by air drying ..		1.2

#### JOE'S BRANCH.

In the following section of Joe's branch the measurements of the strata were made along the road from Joe's branch to the gap leading to Johns fork of Beefhide. The Elkhorn sinks below drainage on Joe's branch at a point about 1¼ miles up at an elevation of about 1615 feet.

#### Section on Joe's Branch.

Sandstone ..	15 ft.								
Coal, Whitesburg.									
Sandstone ..	40 ft.								
Covered and shale ..	15 ft.								
Sandstone ..	35 ft.								
Covered ..	60 ft.								
Coal, Amburgy.....	<table> <tr><td>Coal ..</td><td>32"</td></tr> <tr><td>Shale ..</td><td>14"</td></tr> <tr><td>Coal ..</td><td>2"</td></tr> <tr><td>Shale ..</td><td>12"</td></tr> </table>	Coal ..	32"	Shale ..	14"	Coal ..	2"	Shale ..	12"
Coal ..	32"								
Shale ..	14"								
Coal ..	2"								
Shale ..	12"								
Sandstone .....	25 ft.								
Covered, shale (?) .....	30 ft.								
Shale .....	40 ft.								
Shaly sandstone .....	10 ft.								
Sandstone .....	15 ft.								
Covered .....	20 ft.								
Sandstone ..	23 ft.								
Shale ..	12 ft.								
Coal, Elkhorn.									
Shale .....	25 ft.								
Coal .....	28"								
Shale .....	5 ft.								
Sandstone .....	16 ft.								
Black slate .....	4 ft.								
Slaty sandstone .....	20 ft.								
Sandstone ..	70 ft.								
Coal ..	27½"								
Clay ..	12"								

MINE No. 204.—Mine No. 204 is located on the right of Elkhorn creek, ½ mile below the mouth of Little Elkhorn creek. Elevation of bottom of coal at pit mouth, 1598.

## Sections in Mine No. 204.

On main entry, 5650 feet in:

Coal .....	43"
Clay .....	3"
Coal .....	47½"
Clay floor.	

At face of first west heading:

Coal .....	45"
Clay .....	7½"
Coal .....	43½"
Clay bottom.	

At face of first right heading, 2d west:

Coal .....	40"
Shale .....	2"
Coal .....	7½"
Shale .....	4"
Coal .....	80½"

The double parting shown in the above is due to a split in the parting, with a wedge of coal between separating the main clay parting. The lower band of clay is separated from the main parting at an acute angle and extends down into the coal for a few feet and then fades out.

A sample of coal was taken for analysis at the place where the following section was made:

Section in Room 15, 1st left, off 1st east, 2580 feet from Pit entry.

1. Shale.	
2. Black slate .....	3"
3. Coal left as roof .....	12"
4. Coal .....	36"
5. Clay .....	5½"
6. Hard coal .....	10"
7. Splint .....	5"
8. Hard coal .....	82½"
9. Clay floor.	

Analysis of Coal from Mine No. 204. Excluded from Sample, Nos. 1, 2, 3, 5, and 9.

Laboratory No. G-3718, Elkhorn Coal, No. 204 mine, Jenkins. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.15	2.22
Volatile combustible matter .....	36.78	36.38
Fixed carbon .....	59.05	53.41
Brown ash .....	3.02	2.99
Total .....	100.00	100.00
Sulphur .....	.55	.54
B. T. U. per pound .....	14,520.00	14,360.00
Specific gravity .....	1.288	
Moisture lost by air drying .....		1.08

## LITTLE ELKHORN CREEK.

The main Pine mountain fault just west of Jenkins is north of the lower portion of Little Elkhorn creek. In excavating for the main office building at Jenkins the strata were found greatly disturbed and standing at a high angle dipping to the southeast into Pine mountain. The fault has a northeast-southwest direction and crosses Little Elkhorn creek at a point 500 feet above where the creek changes from a southeast to a northeast course. The high ridge parallel to and just north of the lake, is formed of a very hard conglomerate quartzite, the strata dipping to the southeast at an angle of 45 degrees. Where the fault crosses Little Elkhorn below the mouth of Childs branch, a coal has been forced up in the fault and lies adjacent to the conglomerate quartzite.

At a point 90 feet above the first branch which enters Little Elkhorn on the right below the mouth of Childs branch, is another fault.

Just above the mouth of Childs branch the strata are dipping to the southwest at a low angle. A coal with the following bed section has been opened at a point 200 feet north of the mouth of Childs branch. This coal is about 40 feet above the top of the Elkhorn coal.

## Elkhorn Rider.

Shale.	
Sandstone .....	8 ft.
Shale, rich in fern impressions, reeds, ferns, etc.	8 ft.
Coal .....	2½"
Shale .....	8"
Coal .....	1½"
Rashy shale .....	4"
Laminated coal .....	3"
Dark shale .....	¾"
Laminated coal .....	4½"
Hard coal .....	23"
Blue clay bottom.	

From the mouth of Childs branch to the forks of Little Elkhorn creek, a distance of ¼ mile, the strata show a southwest dip.

The same coal as that at the mouth of Childs branch and at an elevation 17 feet higher, has been opened on the left of Little Elkhorn creek just above the forks. The latter opening is directly over the main entry of No. 205 mine, with an interval of 40 feet to the top of the Elkhorn coal.

MINE No. 205.—Mine No. 205 is located on the left of Elkhorn creek, ½ mile above the mouth of Little Elkhorn creek. The elevation of the bottom of the coal at the pit mouth is 1589 feet.

## Section Below Elkhorn Coal at the Tipple.

Shale which weathers into vertical joints.	
Elkhorn coal.	
Shale .....	20 ft.
Coal .....	30"
Highly siliceous slate containing knife-edge coal, iron oxide and mica .....	19 ft.
Black, bituminous slate .....	13"
Coal, well cleated with thin bone 4 inches from top .....	14"
Clay .....	6"
Gray, micaceous sandstone containing plant impressions at top and iron concretions.	

## Sections in Mine No. 205.

At face of No. 2, south off main, 1000 feet from main:

Coal .....	51"
Rash .....	1"
Clay parting .....	25"
Coal .....	57"
Clay bottom.	

No. 2 room, 1st left off 1st north, 1600 feet from pit mouth:

Black slate roof.	
Coal .....	45"
Clay .....	10"
Coal .....	43"
Clay bottom.	

## Analysis of Coal from Above.

Laboratory No. G-3719, Elkhorn coal, No. 205 mine, Jenkins. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.40	2.67
Volatile combustible matter .....	36.56	36.08
Fixed carbon .....	59.49	58.73
Brown ash .....	2.55	2.52
Total .....	100.00	100.00
Sulphur .....	.58	.57
B. T. U. per pound .....	14,680.00	14,490.00
Specific gravity .....	1.278	
Moisture lost by air drying .....		1.28

In this mine the clay parting gradually thickens from the main headings to the south and attains a maximum thickness in the south headings of 39 inches. To the north, places occur where the clay disappears completely to reappear again in a short distance. The parting here is too hard to be cut with a machine and has to be loosened by shooting it. Where the parting is thick, small lenses of flint fire-clay occur in it 4 to 6 inches from the bottom. The top of the clay is apparently level, the variation in the thickness of the clay being caused by the inequalities in the thickness of the lower bench of coal.

MINE No. 206.—The main opening of No. 206 is on the left of Elkhorn creek, ½ mile above No. 205. The

elevation of the bottom of the coal at the pit mouth is 1583 feet, showing a fall of 6 feet from No. 206 to No. 205.

The thickness of the clay parting in No. 206 is, on the average, less than in No. 205. The parting here, unlike that in No. 205, is soft and is removed by undercutting it with a machine. An average bed section of the coal in the mine is shown in the following:

**Average Section in Mine No. 206.**

Coal .....	48"
Clay .....	4"
Coal .....	47"
Clay bottom.	

In certain localities where the parting assumes an abnormal thickness, the lower half of it is composed of a very fine siliceous sandstone.

A sample of coal was collected from the second right, first north, 1000 feet in, where the following section was obtained:

**Section in Mine No. 206.**

Black slate ....	2"
Coal .....	40"
Clay .....	½"
Hard coal ....	9"
Splint .....	11"
Hard coal .....	26½"
Soft coal .....	3"
Clay bottom.	

**Analysis of Coal from Mine No. 206.**

Laboratory No. G-3723, Elkhorn coal, Mine No. 206, Jenkins. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.37	2.28
Volatile combustible matter .....	37.49	37.15
Fixed carbon .....	58.41	57.87
Brown ash .....	2.73	2.70
Total .....	100.00	100.00
Sulphur .....	.57	.57
B. T. U. per pound .....	14,830.00	14,690.00
Specific gravity .....	1.275	
Moisture lost by air drying .....		.92

**MINE No. 207.**—Mine No. 207 is located on the left of Elkhorn creek ¾ mile above No. 206. The elevation of the bottom of the coal at the mouth of the mine is 1630 feet, showing a rise of the coal up Elkhorn creek from No. 206 of 47 feet. In mines 205 and 206 the dip is 5 per cent. to the southwest. In No. 207 the dip changes to the northwest at the rate of about 1 per cent.

The parting in No. 207 varies from 1 to 5 inches with an average of 4 inches. It is soft except in the western part of the mine, where it thickens to 12 inches or more and is so hard that it is removed by cutting the coal just below it and prizing it down. Coincident with the thickening of the clay parting the rash at the bottom thickens to as much as 12 inches.

**Sections in Mine No. 207.**

On No. 1 east loaded, 450 feet from main:

Shale.	
Black slate .....	1"
Coal .....	40"
Clay .....	1 to 4"
Coal .....	45"
Clay floor.	

On the right, 500 feet from Pit mouth:

Shale.	
Black slate .....	1"
Coal .....	42"
Clay .....	3"
Coal .....	45"

At the latter place a sample was taken for analysis.

**Analysis of Coal from Mine No. 207.**

Laboratory No. G-3721, Elkhorn Coal, Mine No. 207, Jenkins. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.46	2.60
Volatile combustible matter .....	36.24	35.82
Fixed carbon .....	57.44	56.78
Brown ash .....	4.86	4.80
Total .....	100.00	100.00
Sulphur .....	.61	.60
B. T. U. per pound .....	14,340.00	14,175.00
Specific gravity .....	1.275	
Moisture lost by air drying .....		1.15

MINE No. 208.—The pit mouth of mine No. 208 is about 100 feet from No. 207, and may be considered a part of the latter. They are both operated under one foreman and the coal is dumped over the same tippie. A bed section of the seam with the resulting analysis of the coal are given below.

Section in Mine No. 208.

Coal left as roof.....	12"
Coal .....	30"
Clay .....	4½"
Hard coal .....	9"
Splint .....	11"
Hard coal .....	24½"
Clay bottom.	

The coal left as roof and the clay parting were excluded in the sample taken for analysis.

Analysis of Coal from Mine No. 208.

Laboratory No. G-3722, Elkhorn coal, Mine No. 208, Jenkins. Average sample.

Analysis—Per cent.	Air-dried	As received
Moisture .....	1.36	2.37
Volatile combustible matter .....	36.88	36.50
Fixed carbon .....	58.09	57.50
Grayish-brown ash .....	3.67	3.63
Total .....	100.00	100.00
Sulphur .....	.57	.56
B. T. U. per pound .....	14,510.00	14,360.00
Specific gravity .....	1.291	
Moisture lost by air drying .....		1.02

BEEFHIDE CREEK OF SHELBY CREEK.

As shown on the map accompanying this report, that part of Beefhide creek above the mouth of Booker branch lies in Letcher county.

At the mouth of Booker branch the Elkhorn coal is about 380 feet above the bed of Beefhide creek. The coal rises rapidly up Booker branch and goes below drainage near the head of the branch, 1 mile up, at an elevation of 1585 feet. From the head of Booker branch to where the coal sinks below drainage on Ikes fork, a distance of 2 miles, the northwest dip is 94 feet.

The outcrop line, with the various bed sections of the Elkhorn coal on Beefhide, were supplied by the Consolidation Coal Company.

Sections of Elkhorn coal on Beefhide creek above Booker branch:

BOOKER BRANCH.

On the right, 500 feet up. Elevation, 1550:

Coal . . . . .	36"
Clay . . . . .	1"
Coal . . . . .	43"

On the left, 1500 feet up. Elevation, 1560:

Coal .....	48"
Clay .....	2"
Coal .....	48"

On the right, 3500 feet up. Elevation 1583:

Coal .....	32"
Clay . . . . .	1"
Coal . . . . .	33"

On the left, 4000 feet up. Elevation, 1586:

Coal .....	39"
Clay .....	1"
Coal .....	27"

On the right, 4600 feet up. Elevation, 1583:

Coal . . . . .	29"
Clay . . . . .	9"
Coal . . . . .	31"

JOHNS FORK.

On the right, 1200 feet up:

Coal . . . . .	36"
Clay . . . . .	5"
Coal . . . . .	38"

On the left, 3500 feet up. Elevation, 1557:

Coal . . . . .	39"
Clay .....	4"
Coal .....	43"

Between Grays branch and road fork. Elevation, 1586:

Coal . . . . .	31"
Clay . . . . .	4"
Coal . . . . .	42"

On Grays branch, 4700 feet up. Elevation, 1616:

Coal ..... 39"  
Clay ..... 6"  
Coal ..... 39"

Bore hole No. 3, at head of Johns fork:

Coal ..... 39"  
Clay ..... 1"  
Coal ..... 28"

On right of 1st right branch above Johns fork. Elevation 1545:

Coal ..... 34"  
Clay ..... 15"  
Coal ..... 33"

At head of same branch. Elevation, 1530:

Coal ..... 20"  
Clay ..... 5"  
Coal ..... 40"

On left of Beefhide, 2000 feet above Johns fork:

Coal ..... 47"  
Clay ..... 6"  
Coal ..... 38"

On the right of Andy Wrights fork, 1500 feet up. Elevation, 1501:

Coal ..... 41"  
Clay ..... 1"  
Coal ..... 48"

On the right of Ikes fork, 2800 feet up. Elevation 1491:

Coal ..... 39"  
Clay ..... 9"  
Coal ..... 30"

On the left of Middle fork, 3300 feet up. Elevation, 1514:

Coal ..... 38"  
Clay ..... 2"  
Coal ..... 24"

The Shelby Gap coal is opened on the left of Johns fork,  $\frac{1}{4}$  mile above the mouth of Grays branch, with an interval of about 240 feet below the Elkhorn coal.

**Shelby Gap Coal.**

Massive sandstone.  
Black slate ..... 6"  
Coal ..... 14"  
Laminated coal ..... 4"  
Coal ..... 12"

## ANALYSES.

The following additional analyses of the Elkhorn coal were made by the United States Bureau of Mines acting in co-operation with the Kentucky Geological Survey. Samples were taken from different portions of the mines and analyses made from these and a composite analysis for the whole mine.

Analyses were made in the laboratories of the Bureau of Mines.

J. B. HOEING.

LETCHER COUNTY.

No. 1.

Laboratory number . . . . . 21,303  
 Operator . . . . . Elkhorn Coal Co.  
 Mine . . . . . Elkhorn  
 Location . . . . . Kona  
 Location in mine. . . . . Face of 1st left, off 2d main,  
 450 feet from drift mouth.  
 Coal . . . . . Elkhorn  
 Date of sampling . . . . . 3-6-'15  
 Date of analysis . . . . . 3-19-'15  
 Depth below surface . . . . . 150 feet

SECTION OF MINE.

	Feet	Inches
Roof—Sandstone	20	
Immediate Roof—Sandstone		
1. Coal		5
2. Mother coal		$\frac{1}{2}$
3. Coal	1	$7\frac{1}{2}$
4. Clay shale		$\frac{1}{2}$
5. Coal	1	3
6. Hard coal		2
7. Coal		7
8. Hard coal		1
9. Coal		8
Total	4	$10\frac{1}{2}$
Floor—clay.		
Excluded from sample, No. 4.		

ANALYSIS.

Air-dry Loss, 25		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture	1.80	3.80		
	Volatile matter	37.40	36.45	37.89	39.68
	Fixed carbon	56.85	55.41	57.60	60.32
	Ash	4.45	4.34	4.51	
		100.00	100.00	100.00	100.00
Sulphur		0.98	0.96	1.00	1.05
Calorific Value Determined	Calories	7896	7696	8000	8378
	B. T. U.	14213	13853	14400	15080

## LETCHER COUNTY.

## No. 2.

Laboratory number .....21,306  
 Operator .....Elkhorn Coal Co.  
 Mine .....Elkhorn  
 Location .....Kona  
 Location in mine .....Face of 2d main,  
 600 feet from opening.  
 Coal .....Elkhorn  
 Date of sampling.....3-6-'15  
 Date of analysis .....3-18-'15  
 Depth below surface .....200 feet

## SECTION OF MINE.

	Feet	Inches
Roof—Sandstone	30	
Immediate Roof—Sandstone		
1. Coal . . . . .	1	
2. Mother coal . . . . .		¾
3. Coal . . . . .	1	10
4. Hard coal . . . . .		6
5. Coal . . . . .		6
6. Hard coal . . . . .		2
7. Coal . . . . .		5
Total . . . . .	4	5¾
Floor—clay.		
Excluded from sample, none.		

## ANALYSIS.

Air-dry Loss, 2.1		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.43	3.48		
	Volatile matter.....	38.17	37.38	38.73	40.43
	Fixed carbon .....	56.25	55.08	57.06	59.57
	Ash .....	4.15	4.06	4.21	
		100.00	100.00	100.00	100.00
Sulphur		1.15	1.13	1.17	1.22
Calorific Value Determined	Calories .....	7919	7754	8034	8387
	B. T. U.....	14254	13957	14461	15097

## LETCHER COUNTY.

## No. 3.

Laboratory number .....21,305  
 Operator .....Elkhorn Coal Co.  
 Mine .....Elkhorn  
 Location .....Kona  
 Location in mine .....Face of No. 1,  
 750 feet from opening.  
 Coal .....Elkhorn  
 Date of sampling.....3-6-'15  
 Date of analysis .....3-17-'15  
 Depth below surface .....175 feet

## SECTION OF MINE.

	Feet	Inches
Roof—Sandstone	25	
Immediate Roof—Shaly Slate		6 to 8
1. Coal .....	3	
2. Hard coal .....		4
3. Coal .....		9
4. Hard coal .....		2
5. Coal .....		5½
Total .....	4	8½
Floor—clay.		
Excluded from sample, none.		

## ANALYSIS.

Air-dry Loss, 1.0		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.68	2.68		
	Volatile matter.....	37.95	37.56	38.59	40.24
	Fixed carbon .....	56.34	55.77	57.31	59.76
	Ash .....	4.03	3.99	4.10	
		100.00	100.00	100.00	100.00
Sulphur		0.91	0.90	0.92	0.96
Calorific Value Determined	Calories .....	7918	7837	8053	8398
	B. T. U.....	14252	14107	14495	15116



## LETCHER COUNTY.

## No. 4.

Laboratory number ..... 21,304  
 Operator ..... Elkhorn Coal Co.  
 Mine ..... Elkhorn  
 Location ..... Kona  
 Location in mine..... Face 2d right, off main No. 1,  
 500 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling.. ..... 3-6-'15  
 Date of analysis . ..... 3-18-'15  
 Depth below surface ..... 200 feet

## SECTION OF MINE.

	Feet	Inches
Roof—Sandstone	30	
Immediate Roof—Shaly Slate		6
1. Coal .....	1	5
2. Mocher coal .....		½
3. Coal .....		4½
4. Shale .....		1½
5. Coal .....	1	
6. Hard coal .....		3
7. Coal .....		10
8. Hard coal .....		4
9. Coal .....		6
Total .....	4	10½
Floor—clay.		
Excluded from sample, No. 4.		

## ANALYSIS.

Air-dry Loss, 2.6		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.38	3.91		
	Volatile matter....	37.67	36.70	38.19	39.71
	Fixed carbon .....	57.18	55.72	57.99	60.29
	Ash .....	3.77	3.67	3.82	
		100.00	100.00	100.00	100.00
Sulphur		0.97	0.95	0.99	1.02
Calorific Value Determined	Calories .....	7963	7758	8074	8395
	B. T. U.....	14333	13964	14533	15111

## LETCHER COUNTY.

## No. 5

Laboratory number (composite of 21,303, 21,304, 21,306) ..... 21,307  
 Operator ..... Elkhorn Coal Co.  
 Mine ..... Elkhorn  
 Location ..... Kona  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-6-'15  
 Date of analysis . ..... 3-20-'15

## ANALYSIS.

Air-dry Loss, 2.4		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.44	3.80		
	Volatile matter....	37.64	36.74	38.19	39.86
	Fixed carbon .....	56.80	55.44	57.63	60.14
	Ash .....	4.12	4.02	4.18	
		100.00	100.00	100.00	100.00
Sulphur		1.06	1.03	1.07	1.12
Ultimate Analysis	Hydrogen .....	5.50	5.64	5.43	5.66
	Carbon .....	79.90	77.99	81.07	84.60
	Nitrogen .....	1.58	1.54	1.60	1.67
	Oxygen .....	7.84	9.78	6.65	6.95
	Sulphur .....	1.06	1.03	1.07	1.12
	Ash .....	4.12	4.02	4.18	
Calorific Value Determined	Calories .....	7906	7717	8022	8372
	B. T. U.....	14231	13891	14440	15070
Calorific Value Calculated from Ultimate Analysis		Calories .....	7848		
		B. T. U.....	14126		

## LETCHER COUNTY.

No. 6.

Laboratory number ..... 21,310  
 Operator.....Elkhorn Mining Corporation  
 Mine ..... No. 301  
 Location ..... Fleming  
 Location in mine ..... Face of room 17,  
 1800 feet from drift mouth.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-3-'15  
 Date of analysis ..... 3-18-'15  
 Depth below surface ..... 110 feet

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal		
1. Coal . . . . .	1	■
2. Slate..... } Roof		5
3. Coal..... }		4
4. Coal.....	1	11
5. Dirt.....		1
6. Coal.....		9
7. Hard coal.....		4
8. Coal.....	2	3
Total.....	7	6
Floor—clay.		
Excluded from sample, Nos. 1, 2, 3 and 5.		

## ANALYSIS.

Air-dry Loss, 2.0		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.60	3.61	.....	.....
	Volatile matter.....	36.80	36.05	37.40	39.01
	Fixed carbon .....	57.55	56.37	58.48	60.99
	Ash .....	4.05	3.97	4.12	.....
		100.00	100.00	100.00	100.00
Sulphur		0.61	0.60	0.62	0.65
Calorific Value Determined	Calories .....	7933	7771	8062	8409
	B. T. U.....	14279	13988	14512	15136

## LETCHER COUNTY.

No. 7.

Laboratory number ..... 21,313  
 Operator.....Elkhorn Mining Corporation  
 Mine ..... No. 301  
 Location ..... Fleming  
 Location in mine ..... Face 1st right heading,  
 1400 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-3-'15  
 Date of analysis ..... 3-17-'15  
 Depth below surface..... 125 feet

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal		
1. Slate . . . . .	1	.....
2. Coal . . . . .	Roof	6½
3. Mother coal } .....		½
4. Coal .....	1	■
5. Shale .....		2
6. Coal .....		8
7. Hard coal .....		5½
8. Coal .....	1	3
9. Hard coal .....		2
10. Coal .....		8
Total .....	6	8½
Floor—clay.		
Excluded from sample, Nos. 1, 2, 3 and 5.		

## ANALYSIS.

Air-dry Loss, 0.8		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.79	2.55	.....	.....
	Volatile matter.....	36.74	36.46	37.42	39.03
	Fixed carbon .....	57.43	56.98	58.46	60.97
	Ash .....	4.04	4.01	4.12	.....
		100.00	100.00	100.00	100.00
Sulphur		0.59	0.59	0.61	0.64
Calorific Value Determined	Calories .....	7924	7863	8069	8416
	B. T. U.....	14263	14153	14524	15149

## LETCHER COUNTY.

No. 8.

Laboratory number .....21,309  
 Operator.....Elkhorn Mining Corporation  
 Mine ..... No. 301  
 Location ..... Fleming  
 Location in mine. .... Face of main right heading,  
 1900 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-3-'15  
 Date of analysis ..... 3-18-'15

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal	1	1
1. Coal ..	1	9
2. Shale ..		2
3. Coal ..		9
4. Hard coal ..		4
5. Coal ..	1	3
6. Hard coal ..		1
7. Coal ..	1	3
Total	5	7
Floor—clay.		
Excluded from sample, roof and No. 2.		

## ANALYSIS.

Air-dry Loss, 2.1		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.58	3.69		
	Volatile matter....	37.62	36.81	38.22	39.84
	Fixed carbon .....	56.80	55.59	57.72	60.16
	Ash .....	4.00	3.91	4.06	
		100.00	100.00	100.00	100.00
Sulphur		0.60	0.59	0.61	0.64
Calorific Value Determined	Calories .....	7940	7769	8067	8408
	B. T. U.....	14292	13984	14521	15134

## LETCHER COUNTY.

No. 9.

Laboratory number .....21,308  
 Operator.....Elkhorn Mining Corporation  
 Mine ..... No. 301  
 Location ..... Fleming  
 Location in mine. .... Face of room 4, off 2d left heading,  
 1300 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-3-'15  
 Date of analysis ..... 3-17-'15  
 Depth below surface ..... 135 feet

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal		
1. Coal ..	1	4
2. Shale ..		3
3. Coal ..		9
4. Hard coal ..		4
5. Coal ..	1	3
6. Hard coal ..		2
7. Coal ..	1	
Total	5	1
Floor—clay.		
Excluded from sample, No. 2.		

## ANALYSIS.

Air-dry Loss, 1.2		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.67	2.86		
	Volatile matter....	37.78	37.32	38.42	40.04
	Fixed carbon .....	56.57	55.89	57.53	59.96
	Ash .....	3.98	3.93	4.05	
		100.00	100.00	100.00	100.00
Sulphur		0.71	0.70	0.72	0.75
Calorific Value Determined	Calories .....	7910	7814	8044	8383
	B. T. U.....	14238	14065	14479	15089

## LETCHER COUNTY.

## No. 10.

Laboratory number (composite of Nos. 21,308-9-10-11).....21,312  
 Operator ..... Elkhorn Mining Corporation  
 Mine ..... No. 301  
 Location ..... Fleming  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-3-'15  
 Date of analysis ..... 3-19-'15

## ANALYSIS.

Air-dry Loss, 2.0		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.63	3.64	..	..
	Volatile matter....	37.52	36.75	38.14	39.82
	Fixed carbon .....	56.70	55.54	57.64	60.18
	Ash .....	4.15	4.07	4.22	..
		100.00	100.00	100.00	100.00
Sulphur		0.65	0.64	0.66	0.69
Ultimate Analysis	Hydrogen .....	5.40	5.52	5.31	5.54
	Carbon .....	80.45	78.81	81.79	85.40
	Nitrogen .....	1.61	1.58	1.64	1.71
	Oxygen .....	7.74	9.38	6.38	6.66
	Sulphur .....	0.65	0.64	0.66	0.69
Calorific Value Determined	Calories .....	7912	7751	8044	8399
	B. T. U.....	14242	13952	14479	15118
Calorific Value Calculated from Ultimate Analysis	Calories .....	..	7881	..	..
	B. T. U.....	..	14186	..	..

## LETCHER COUNTY.

## No. 11.

Laboratory number .....21,297  
 Operator ..... Consolidation Coal Co.  
 Mine ..... No. 213  
 Location ..... McRoberts  
 Location in mine..... Face No. 1 right heading  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-5-'15  
 Date of analysis ..... 3-18-'15

## SECTION OF MINE.

	Feet	Inches
Roof—Sandstone	25	
Immediate Roof—Slate and Coal	4	
1. Coal (roof) .....	1	6
2. Coal .....		9
3. Mother coal .....		1
4. Coal .....	1	4
5. Slate shale .....		11
6. Coal .....		10
7. Hard coal .....		4
8. Coal .....	2	1
Total .....	7	10
Floor—clay.		
Excluded from sample, No. 5.		

## ANALYSIS.

Air-dry Loss, 2.0		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.45	3.42	..	..
	Volatile matter....	36.55	35.82	37.09	38.37
	Fixed carbon .....	58.70	57.53	59.57	61.63
	Ash .....	3.30	3.23	3.34	..
		100.00	100.00	100.00	100.00
Sulphur		0.54	0.53	0.55	0.57
Calorific Value Determined	Calories .....	7982	7822	8099	8379
	B. T. U. ....	14368	14080	14578	15082

## LETCHER COUNTY.

No. 12.

Laboratory number . . . . . 21,296  
 Operator . . . . . Consolidation Coal Co.  
 Mine . . . . . No. 213  
 Location . . . . . McRoberts  
 Location in mine . . . . . Face of No. 1 left, off No. 1 right entry  
 Coal . . . . . Elkhorn  
 Date of sampling . . . . . 3-5-'15  
 Date of analysis . . . . . 3-17-'15  
 Depth below surface . . . . . 130 feet

## SECTION OF MINE.

	Feet	Inches
Roof—Sandstone		
Immediate Roof—Coal		
1. Coal	1	10
2. Slate, clay shale		11
3. Coal	1	
4. Hard coal		4
5. Coal	1	3
6. Hard coal		3
7. Coal		10
Total	6	5
Floor—clay.		
Excluded from sample, No. 2.		

## ANALYSIS.

Air-dry Loss, 1.3		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture	1.60	2.91		
	Volatile matter	36.60	36.11	37.19	38.69
	Fixed carbon	58.00	57.23	58.95	61.31
	Ash	3.80	3.75	3.86	
		100.00	100.00	100.00	100.00
Sulphur		0.50	0.49	0.50	0.52
Calorific Value Determined	Calories	7946	7840	8075	8400
	B. T. U.	14303	14112	14535	15120

## LETCHER COUNTY.

No. 13.

Laboratory number . . . . . 21,295  
 Operator . . . . . Consolidation Coal Co.  
 Mine . . . . . No. 213  
 Location . . . . . McRoberts  
 Location in mine . . . . . Face of main entry  
 Coal . . . . . Elkhorn  
 Date of sampling . . . . . 3-5-'15  
 Date of analysis . . . . . 3-17-'15  
 Depth below surface . . . . . 140 feet

## SECTION OF MINE.

	Feet	Inches
Roof—Sandstone		
Immediate Roof—Coal		
1. Coal	2	3
2. Shaly band		5½
3. Coal		10
4. Hard coal		10
5. Coal	1	7
Total	5	11½
Floor—clay.		
Excluded from sample, No. 2.		

## ANALYSIS.

Air-dry Loss, 0.7		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture	1.40	2.06		
	Volatile matter	37.65	37.40	38.19	39.39
	Fixed carbon	57.95	57.56	58.77	60.61
	Ash	3.00	2.98	3.04	
		100.00	100.00	100.00	100.00
Sulphur		0.58	0.58	0.59	0.61
Calorific Value Determined	Calories	8033	7979	8147	8403
	B. T. U.	14459	14362	14665	15125

## LETCHER COUNTY.

No. 14.

Laboratory number .....21,294  
 Operator .....Consolidation Coal Co.  
 Mine .....No. 213  
 Location .....McRoberts  
 Location in mine.....First right, off No. 1 left, face heading  
 Coal .....Elkhorn  
 Date of sampling.....3-5-'15  
 Date of analysis .....3-18-'15  
 Depth below surface .....135 feet

## SECTION OF MINE.

	Feet	Inches
Roof—Sandstone	30	
Immediate Roof—Coal		
1. Coal .....	1	11
2. Shale .....		4
3. Coal .....	1	4
4. Hard coal .....		4
5. Coal .....		6
6. Hard coal .....		1
7. Coal .....	1	9
Total .....	6	3
Floor—clay.		
Excluded from sample, No. 2.		

## ANALYSIS.

Air-dry Loss, 1.9		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.35	3.26		
	Volatile matter...	37.55	36.82	38.06	39.41
	Fixed carbon .....	57.70	56.59	58.50	60.59
	Ash .....	3.40	3.33	3.44	
		100.00	100.00	100.00	100.00
Sulphur		0.59	0.58	0.60	0.62
Calorific Value Determined	Calories .....	7995	7840	8104	8393
	B. T. U.....	14391	14112	14587	15107

## LETCHER COUNTY.

No. 15.

Laboratory number (composite of 21,294-95-96-97).....21,298-F  
 Operator .....Consolidation Coal Co.  
 Mine .....No. 213  
 Location .....McRoberts  
 Coal .....Elkhorn  
 Date of sampling.....3-5-'15  
 Date of analysis .....3-19-'15

## ANALYSIS.

Air-dry Loss, 1.5		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.45	2.92		
	Volatile matter...	36.88	36.33	37.42	38.71
	Fixed carbon .....	58.39	57.52	59.25	61.29
	Ash .....	3.28	3.23	3.33	
		100.00	100.00	100.00	100.00
Sulphur		0.56	0.55	0.57	0.59
Ultimate Analysis	Hydrogen .....	5.57	5.66	5.49	5.68
	Carbon .....	81.06	79.85	82.25	85.08
	Nitrogen .....	1.61	1.59	1.64	1.70
	Oxygen .....	7.92	9.12	6.72	6.95
	Sulphur .....	0.56	0.55	0.57	0.59
	Ash .....	3.28	3.23	3.33	
Calorific Value Determined	Calories .....	7990	7871	8108	8387
	B. T. U.....	14382	14168	14594	15097
Calorific Value Calculated from Ultimate Analysis	Calories .....		8022		
	B. T. U.....		14440		

## LETCHER COUNTY.

No. 16.

Laboratory number ..... 21,301  
 Operator ..... Consolidation Coal Co.  
 Mine ..... No. 214  
 Location ..... McRoberts  
 Location in mine ..... Face of 1st right,  
 1900 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-4-'15  
 Date of analysis ..... 3-19-'15  
 Depth below surface ..... 110 feet

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal		
1. Coal (roof) .....	1	6
2. Mother coal .....		½
3. Coal .....		4
4. Shale .....		3
5. Coal .....	2	7
6. Hard coal .....		2
7. Coal .....	1	6
Total .....	6	4½
Floor—clay		
Excluded from sample, No. 4.		

## ANALYSIS.

Air-dry Loss, 2.1		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.30	3.37	.....	.....
	Volatile matter....	37.85	37.06	38.35	39.95
	Fixed carbon .....	56.90	55.70	57.64	60.05
	Ash .....	3.95	3.87	4.01	.....
		100.00	100.00	100.00	100.00
Sulphur		0.61	0.60	0.62	0.65
Calorific Value Determined	Calories .....	7955	7788	8060	8397
	B. T. U. ....	14319	14018	14508	15115

## LETCHER COUNTY.

No. 17.

Laboratory number ..... 21,317  
 Operator ..... Consolidation Coal Co.  
 Mine ..... No. 214  
 Location ..... McRoberts  
 Location in mine ..... Face of 2d left, off 1st left face entry,  
 2750 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-4-'15  
 Date of analysis ..... 3-18-15  
 Depth below surface ..... 140 feet

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal		
1. Coal .....	2	5
2. Shale .....		1½
3. Coal .....		10
4. Hard coal .....		4
5. Coal .....	2	9
Total .....	6	5½
Floor—clay.		
Excluded from sample, No. 2.		

## ANALYSIS.

Air-dry Loss, 1.7		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.40	3.06	.....	.....
	Volatile matter....	37.60	36.97	38.14	39.67
	Fixed carbon .....	57.20	56.23	58.00	60.33
	Ash .....	3.80	3.74	3.86	.....
		100.00	100.00	100.00	100.00
Sulphur		0.59	0.58	0.60	0.62
Calorific Value Determined	Calories .....	7992	7858	8106	8432
	B. T. U. ....	14386	14144	14591	15178

## LETCHER COUNTY.

No. 18.

Laboratory number ..... 21,300  
 Operator ..... Consolidation Coal Co.  
 Mine ..... No. 214  
 Location ..... McRoberts  
 Location in mine ..... Face of 1st, off 1st right,  
 2400 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-4-'15  
 Date of analysis ..... 3-18-'15  
 Depth below surface ..... 130 feet

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal		
1. Coal	1	10
2. Shale		3½
3. Coal	3	0
4. Hard coal		3
5. Coal	1	6
Total	6	10½
Floor—clay.		
Excluded from sample, No. 2.		

## ANALYSIS.

Air-dry Loss, 1.8		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture	1.35	3.11		
	Volatile matter	37.75	37.08	38.27	39.96
	Fixed carbon	56.70	55.68	57.47	60.04
	Ash	4.20	4.13	4.26	
		100.00	100.00	100.00	100.00
Sulphur		0.63	0.62	0.64	0.67
Calorific Value Determined	Calories	7948	7807	8058	8417
	B. T. U.	14306	14053	14504	15151

## LETCHER COUNTY.

No. 19.

Laboratory number ..... 21,299  
 Operator ..... Consolidation Coal Co.  
 Mine ..... No. 214  
 Location ..... McRoberts  
 Location in mine ..... Face of 2d right face heading,  
 2900 feet from opening.  
 Coal ..... Elkhorn  
 Date of sampling ..... 3-4-'15  
 Date of analysis ..... 3-18-'15  
 Depth below surface ..... 140 feet

## SECTION OF MINE.

	Feet	Inches
Roof		
Immediate Roof—Coal		
1. Coal	2	7
2. Shale		3
3. Coal	1	1
4. Hard coal		2
5. Coal	2	2
Total	6	3
Floor—clay.		
Excluded from sample, No. 2.		

## ANALYSIS.

Air-dry Loss, 2.1		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture	1.05	3.08		
	Volatile matter	37.75	36.98	38.16	39.35
	Fixed carbon	58.20	57.00	58.81	60.65
	Ash	3.00	2.94	3.03	
		100.00	100.00	100.00	100.00
Sulphur		0.51	0.51	0.53	0.55
Calorific Value Determined	Calories	8085	7919	8171	8426
	B. T. U.	14553	14254	14708	15167



## LETCHER COUNTY.

No. 20.

Laboratory number (composite of 21,299-300-301-302).....21,302  
 Operator .....Consolidation Coal Co.  
 Mine .....No. 214  
 Location .....McRoberts  
 Coal .....Elkhorn  
 Date of sampling .....3-14-'15  
 Date of analysis .....3-20-'15

## ANALYSIS.

Air-dry Loss, 1.9		Coal Air Dried	Coal as Received	Coal Moisture Free	Coal Moisture and Ash Free
Proximate Analysis	Moisture .....	1.33	3.20	.....	.....
	Volatile matter....	37.47	36.76	37.98	39.46
	Fixed carbon .....	57.50	56.41	58.27	60.54
	Ash .....	3.70	3.63	3.75	.....
		100.00	100.00	100.00	100.00
Sulphur		0.61	0.60	0.62	0.64
Ultimate Analysis	Hydrogen .....	5.46	5.57	5.38	5.59
	Carbon .....	80.98	79.44	82.07	85.27
	Nitrogen .....	1.62	1.59	1.64	1.70
	Oxygen .....	7.63	9.17	6.54	6.80
	Sulphur .....	0.61	0.60	0.62	0.64
	Ash .....	3.70	3.63	3.75	.....
Calorific Value Determined	Calories .....	7980	7828	8087	8402
	B. T. U.....	14364	14090	14557	15124
Calorific Value Calculated from Ultimate Analysis	Calories .....	.....	7955	.....	.....
	B. T. U.....	.....	14319	.....	.....